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It is wise to listen with sympathy to the suggestions of plant executives in behalf of new equipment and new methods; if their suggestions are sound, they can prove it by the increase in net profits that will arise from the changes they advocate

Where to Look For Net Profits

By Col. Frank A. Scott
President of The Warner & Swasey Co.

THE basic problem of the executive in the great American metal working industry today is that of net profits. Most concerns have shown an excellent volume of business but a very disappointing margin of profit. There has been no lack of effort on the part of the executive; overhead has been cut; advertising curtailed; mercy solicited from tax authorities; everywhere rigid economy enforced. But here is the milk in the coconut. The same restrictive policy that has been applied to overhead and other indirect expenses, has been applied to the investment of capital in labor saving and profit producing machinery with unfortunate results.

Perhaps one reason for this attitude has been the confusion existing in the minds of many industrial executives about the opportunities in their own shops. There have been a great many vague and general claims of machine tool builders about the possibilities of production. The chief executive often wonders whether different types of machines will produce savings under his conditions. Moreover, the chief executive many times is not a production expert, and is puzzled by these general statements. He knows that he has a shop full of equipment, part of which perhaps is idle, and perhaps he knows that his competitor is apparently successful in fulfilling a contract which was taken at a figure well below his own.

The needs of the automotive industry, and the inspiration of its marvelous development, drove the American machine tool industry twenty-five years ahead in a period of only fifteen. The war needs and war experience accomplished a similar result. Everything has changed. If we act, and apply the lessons promptly, most things have changed for the better. We know more about machine tools; machining methods; tooling equipments; jigs and fixtures; cutting steels; alloy steels; power transmission; heavier cuts; higher speeds, tolerances and gages, and all the rest of the phenomena than we ever knew before, or than any other nation knows now.

Can we utilize our knowledge? Can we turn it to a profit for ourselves and those we serve? The machine tool maker must bear the chief burden. If he can be only a "machine tool peddler," as he has sometimes scornfully been called, so much the worse for all concerned. If he is to be more than this, then he must be accepted for what he really is—the herald of a new era in metal working; the production engineer who

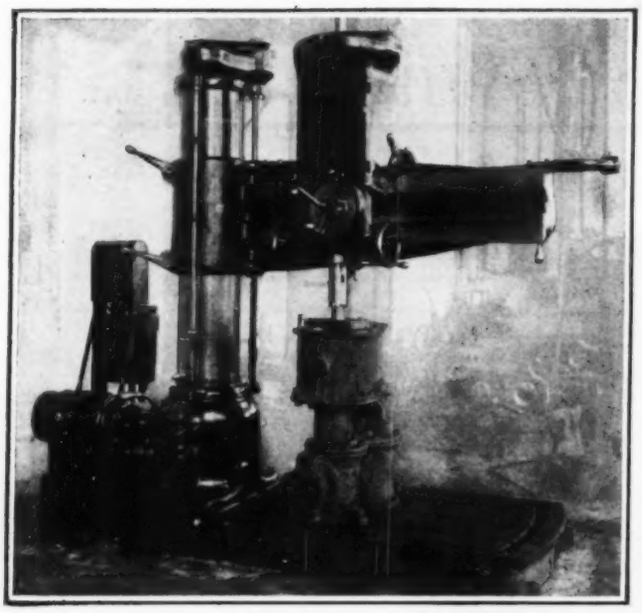

Fig. 1—A radial drill that showed a net profit of 201.3 per cent

can show how to make on small lots as well as large ones.

In the field of metal cutting, the modern executive reckons with four fundamental changes which affect his day-to-day processes. The metals used have become more tough and durable in recent years, and the use of such materials as chrome nickel steel makes necessary heavier and more powerful machine tools. There has also been a change in the standards of accuracy of the finished product, and the limits of accuracy commonplace nowadays in production work, a few years ago were realized only in tool room work. Accuracy is thus demanded of metal working machinery and the product can be no more accurate than the "master tools of industry."

Machine tool producers must also take advantage of the progress in high-speed steel and other super-cutting materials. New designs of machines and tools, therefore, must utilize the full power of these newer cutting materials by showing increased efficiency on metals more difficult to machine than those formerly worked, and with closer and closer limits of accuracy. This means another phase in tool development, almost as impressive as was the change from a wood turning to a steel turning lathe.

These four factors, the change in metals; the improvements in accuracy; the development of high-speed steel and other cutters, and the improvement in machine design, furnish the opportunities for advancement in our metal working factories today and supply the basic reasons for the greatly increased earning power of modern equipment. Let us examine a few examples of modern production equipment.

To show the effectiveness of heavier and more modern tools equipped with high-speed steel cutters, the reboring operation on air pump cylinders in a railroad shop was reduced from 540 to 210 min. by a six-foot triple-purpose American radial drill, Fig. 1. Not only was the time reduced by the heavier and more powerful machine, but the resulting bore was fine and smooth without any trace of gear marks because of the internal gear drive. This equipment produced direct net profits of 201.3 per cent per year.

The process of grinding has had a very interesting development since the war. Wider faced wheels are being used for multiple grinding, double wheels with two diameters are used for different steps of the finished product, and the speeds and feeds of grinders have been materially increased.

To show what these general statements, which we all hear so often, really mean in a typical shop, the Norton Company has reduced the production time of roller bearing cups from one-third of a minute to one-tenth of a minute. This increase in production is due

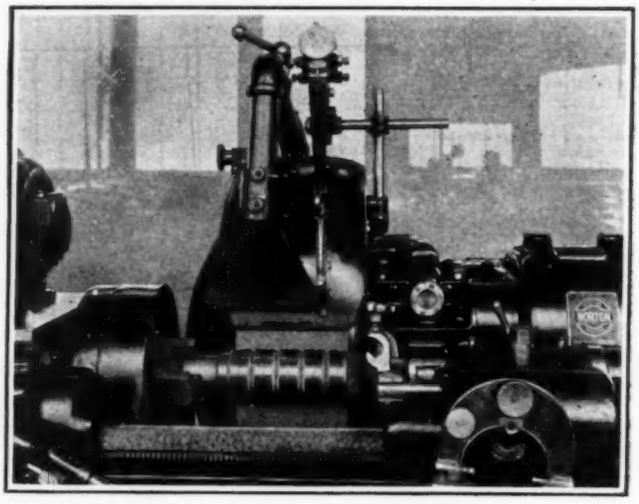

Fig. 2—Grinding nine roller bearing cups at once at a net profit of 282.4 per cent

to the 6¾-in. wide wheel used, which grinds nine cups held on an arbor with one straight-in cut, Fig. 2. The development in design that permits this is a recip-

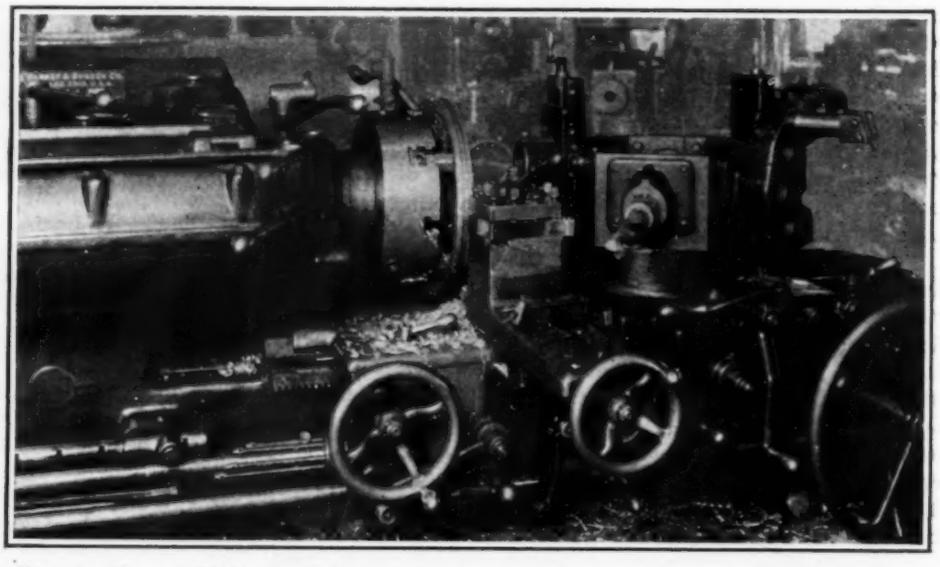

Fig. 3—Turret lathe applied to sprocket job at a net profit of 301.2 per cent

rocating attachment that oscillates the wheel ⅛ in. sideways while grinding. The in-feed is automatic so that the operator loads one arbor while another is being ground. It is interesting to note that this machine shows net profits on the investment required of 282.4 per cent.

The automotive industry has focussed our attention on the profits amassed from large scale production; but the possibilities of the small production field are too important to be ignored. Probably two-thirds of the metal working shops of this country cannot be classed as mass production plants. Therefore, the chances of net profits for most of us lie in exploiting opportunities presented in savings and production on lots of five to fifty pieces.

All bankers know people who are planning to economize and start savings accounts when their incomes are larger. They are as common as the manufacturer who is planning to improve his methods and lower his costs of machining as soon as his volume is large enough to justify automatics. Every job in the shop, large or small, should be made to yield its proportion of profit. The manufacturer who ignores the possibilities of profit on small lot production, is as crippled as a banker would be if blind to the advantage of compound interest.

Condensed Net Profit Statement

Making Main Drive Sprockets for Coal Handling Machinery

Former time	315 minutes
W & S time	79 minutes
Saving	236 minutes

This means

An Investment in Equipment of	$2811.00
Produced a Gross Profit of	9030.80
or, after depreciation, a NET PROFIT of	8468.60

The per cent of Net Profit on the Investment is 301.2 per cent Per Year

In the metal turning field small lot production was formerly secured almost entirely from engine lathes. Now, the rigidity, power and the operation of two or more cutting tools at one time, which a modern turret lathe gives, cuts the production time at least in half in the majority of cases.

The main drive sprocket, shown in Fig. 3, was formerly done on an engine lathe, the time being 315 min. each for a lot of fifteen. Later a boring mill was used with a slight reduction in this time. Now the Warner & Swasey turret lathe produces this part in 75 minutes. Extensive cost records of this producer of coal-handling equipment, covering a large variety of work handled by this machine with standard tools, show that the average time on the turret lathe is about one-third of that of the engine lathe, and that the net profit on this installation is 301.2 per cent.

It is a common fallacy that quantity production requires special tools that produce results far beyond those possible with standard equipment. In the last few years the equipment available for standard machines has been greatly increased and it is possible to tool many quantity jobs just as efficiently with standard tools costing a reasonable amount, as it is with highly special tool equipment. In fact, many machine tool makers do not recommend special tool equipment even for quantity production, unless the piece is difficult to hold, or unusual contours are required, or heavy multiple cuts can be obtained by special tools only.

In one instance the time for making drive-end housings for automobile starters was cut from 27 min. to 10 min. by a small modern machine with strictly standard tool equipment which cost only $240. Certainly special equipment to do this work would have cost two or three times this amount and then would not have been available for other work within its range. In the wise selection of standard tools lies a field for employing capital to good advantage.

While savings in cost produce net profits, and profits are important, still at times the accuracy of the finished product is even more important. For example, there have recently been developed machines for grinding the teeth of spur gears used in automobile transmissions. The finished gear is of superior quality, very quiet, and it has been adopted by leading motor car manufacturers.

And yet figures received recently from one of the most prominent motor car companies show that on the gears in their transmission the cost is lower for hobbing and grinding the teeth than for shaping and lapping them. For example, one gear formerly cost $1.02 and now costs $0.84. Another gear formerly cost $1.00 and now costs $0.79. The only difficulty this manufacturer is now having with his transmission comes from the two gears which he is unable to grind. The illustration, Fig. 4, shows a Lees-Bradner gear grinding machine working on one of these gears.

One example of the specialization in the machine tool field is the use of standard threading machines for cutting a large variety of threads. The savings compared with former methods, such as the familiar screw cutting methods on an engine lathe, are very high. Fig. 5 shows a single-head lead screw threading machine of the Landis Machine Company in the plant of a manufacturer of presses.

Prior to the installation of the Landis machine these lead screws were cut on a lathe, taking 172 min. each. This machine cut the time to less than 1 min. each. This hardly seems believable and yet tremendous savings from this type of machine are realized on threading work. In this case, one machine replaced six men and six lathes and was then operated only a part of the time on this particular job. It is impossible to figure the net profits on this installation because the new machine cost less than the actual second-hand value of the machines replaced; in other words, the change released fixed capital.

"Every potter praises his own pots," and every machine tool man is a ready exponent of the theory that greater profits accrue from better tooling. To let the world know we have found a better way is a serious duty. Perhaps it is not equally a duty to hurl epithets at those who will not listen. Let their negligence recoil on their own heads, and their loss or meager profit be reflected in their own balance sheets.

The advantage of sticking to our berrybush was a homely truth first recognized on the farm, but it applies to the metal worker as well. Under the conditions now existing, if we are to survive, we must explore our own field of production. There is many a job in every metal working shop that is concealing from the management possible profit. We must listen with sympathy to the suggestions of plant executives in behalf of new equipment and new methods; if their suggestions are sound, they can prove it by the increase in net profits which will arise from the changes they advocate.

Considerable activity has been shown by executives in reducing overhead and stimulating sales organization. This is always in order, but it does not lessen the importance of utilizing to the utmost the new opportunities for production and profit, that have developed since the war in machine tool equipment.

At the start the position may be taken by the chief executive that unless the machine tool salesman can show him a net profit on his investment in modern equipment, he will not buy. Suppose for example, that the manufacturer of coal handling machinery cited in one of the illustrations had been skeptical about installing this machine, would not the net profit statement shown here have proved the point? And yet there are literally thousands of shops in this country which provide the very best kind of field for investment under conditions within their control.

The field for the profitable employment of modern machine tool equipment is not limited to the companies that are purely metal working in their nature. There are many industries where the metal cutting function is relatively unimportant. For example, the chief engineer of a large copper mining plant stated recently to one of our men that he could not obtain an appropriation for new machine tools for the maintenance shop of a large mine, although it seemed to him that millions of dollars of capital were available for any change in operating methods that would save a few cents a ton in the mining or crushing of the ore.

It will be possible to replace the existing equipment in this maintenance shop with half the number of machines and show a very handsome net profit on the investment, yet the interest of the executives of this company is seemingly centered in operating machinery to the exclusion of any consideration of the net profits

Fig. 5—A threading machine that eliminated six lathes and released their operators for other work

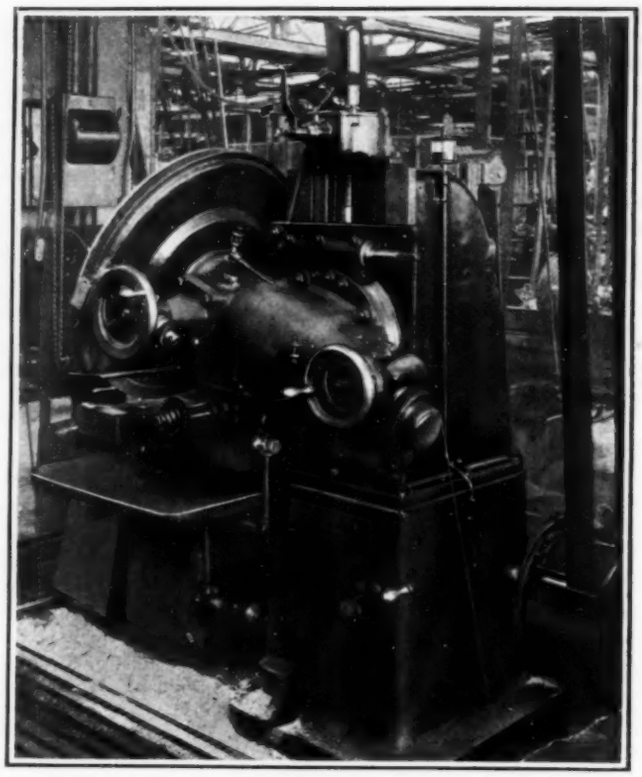

Fig. 4—Greater accuracy in gear tooth grinding and reduced cost as well

to be derived from a relatively small investment in a subsidiary operation.

Somebody taught us when we were boys that opportunity is always knocking at the door. The machine tool salesman may not resemble our mental picture of opportunity; in fact, he is seldom a heroic figure, but for many concerns whose profits are limping, he carries the remedy that will put them on their feet again.

Let the American metal working executive study the possibilities for capital investment in modern machine tools, and the narrow profit margins will slowly but surely widen. There may be poetry in the following lines, but for many a metal working shop there is more truth than poetry:

"New occasions teach new duties,
Time makes ancient *good* uncouth."

Sizes of Standardized Lockers Reduced to Twelve

The march of simplification goes steadily on. Two of the latest fields that have "come through" are steel reinforcing bars and steel lockers, the latter being of particular interest to machine shops and similar industries. The number of sizes has been reduced to 12 for single-tier and 5 for double-tier lockers, these numbers including all varying sizes in the different heights. The general dimensions vary from 12x12 to 18x24 in., with heights of from 66 to 90 in., the complete dimensions being given in Simplified Practice Recommendation No. 35, which can be had from the Government Printing Office for 5 cents. The standard sizes should be available to all who are contemplating shop changes that involve locker-room equipment.

Master Gages and the Higher Courts in Measuring

By Joseph Kaye Wood
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The basis for standards of measurement—The International Prototype Meter—Gage manufacture—The master gage for duplication of work—Checking and maintaining its accuracy

MASTER gages, although not used as often as the working or inspection gages should be checked periodically against what may be called the Manufacturer's Primary Standard from which they were originally derived. This Primary Standard, which for brevity will be called the M-Standard hereafter, should in turn be derived from the National Primary Standard or Meter Bar No. 27, maintained at the Bureau of Standards in Washington, D. C. The latter bar is a duplicate of the International Prototype Meter, a line standard whose length is the distance between two lines ruled on a platinum-iridium bar carefully preserved in a special vault at the International Bureau of Weights and Measures near Paris. Since the English System of length units was adopted for general use in the United States it was necessary to legalize the yard and consequently the inch. In 1893 the United States Government passed a law establishing the value of the yard in accordance with the following relation:

$$1 \text{ meter} = 39.37 \text{ inches.}$$

The British Government on the other hand has legalized a more accurate relation, namely:

$$1 \text{ meter} = 39.370113 \text{ inches.}$$

The word "accurate" here is used in a more or less obscure sense, because after all a unit is arbitrarily chosen or established. What is meant is that the second equation expresses more accurately the comparison between the British Imperial Yard and the International Prototype Meter. The meter-length was more logically chosen than the yard-length since it is equal to one ten-millionth of the distance from the pole to the equator, measured on a meridian passing near Paris, while the original yard was equal to the arm of King Henry I.

Care in Keeping Standards

Modern manufacture of interchangeable machine parts in some cases allows a tolerance of only ± 0.0001 in., which necessitates working and inspection gages of very high precision. It is quite obvious therefore that the master gages should be accurate to at least ± 0.00005 in., while the M-Standard should be of still a higher order of precision. It is still further obvious why the M-Standard should be derived from, or compared with, the National Primary Standard directly because otherwise the errors accumulating from too many comparisons would be too great. The M-Standard therefore, which may be of the end to end or line to line type, is usually kept in a safely guarded place, sometimes in a vault and sometimes in a specially prepared metrology room. The three main safeguarding features incorporated in this room are; dry or non-corrosive air, proper constant temperature and the restriction of access to the room to certain authorized persons.

Precision is the determining factor in the relation between interchangeable manufacture and the ultimate standard. Whether the ultimate standard should be the International Meter, the National Duplicate Meter or even the M-Standard itself depends largely upon commercial conditions. World progress in the way of faster transportation and communication has brought all people into a more connected social order, so that further progress unbiased by political influence demands a common ultimate standard of length in practice as well as in theory. Even in cases where the limits of commercial activity are rather narrow, the ultimate standard should unquestionably be the International Meter. The foregoing may appear like begging an argument, since the principle advocated is generally accepted. But is it practiced? Unconsciously it is not, as the following example will make clear:

A metal piece is to be manufactured to a nominal dimension of N and a tolerance of $\pm T$. The working gage for the upper limit is made to limiting dimensions of $(N + T) \pm t_x$. The same expression likewise applies to the master gage, M-Standard, National Meter and other copies of the International Meter, except that the value of t_x will be different in each case for a given temperature. The variation of t_x is thus shown graphically in Fig. 1, with a zero value for the ultimate or International Standard, which of course is always the case. Fig. 1 represents a given set of conditions under which one manufacturer is to make the metal piece. A different manufacturer would probably make the piece in accordance with Fig. 2.

Taking the Ultimate Standard

Precision is a relative term meaning the most probable deviation of one true length from another true length. Hence, if both manufacturers consider their own M-Standard as ultimate then the precision of the master gage in Fig. 1 is higher than that in Fig. 2. On the other hand, if the International Meter is considered the ultimate standard by both manufacturers, then the master gage in Fig. 2 is of higher precision than that in Fig. 1. Or, in the case of one choosing the M-Standard and the other the International Meter

as the ultimate standard, it is possible for both master gages to be of equal precision although of unequal lengths. Manufacturers unconsciously choose their M-Standards as ultimate standards when they fail to check them periodically. When similar neglect causes the master gages to become ultimate standards then the condition is intolerable.

To establish an M-Standard a manufacturer must first select a steel having the maximum stability at room temperature after a given heat-treatment and one that is preferably non-corrosive. A good steel for this

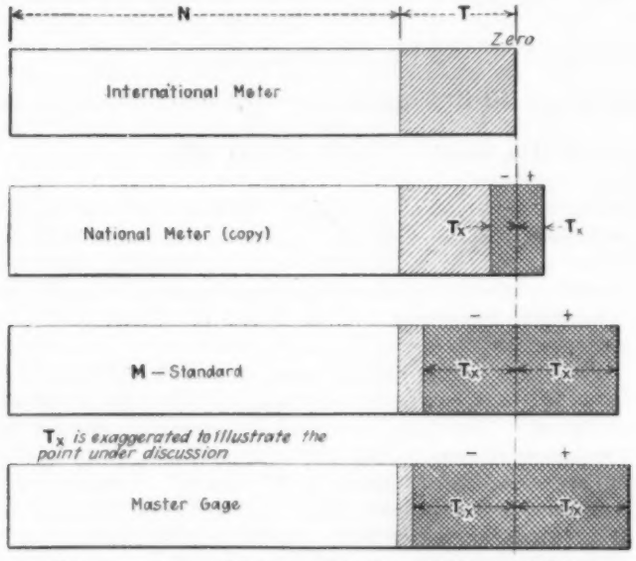


Fig. 1—A graphic presentation of the variables in gage manufacture

purpose may have 58 per cent nickel which has about the same coefficient of expansion as ordinary steel and is non-corrosive. The Bureau of Standards, Johansson and Pratt & Whitney use a steel of about the following composition for their gages:

Carbon	1.00	to 1.10	per cent
Manganese	0.30	to 0.40	" "
Chromium	1.30	to 1.50	" "
Silicon	0.20	to 0.30	" "
Phosphorus	0.025		" "
Sulphur	0.025		" "
Iron	Balance		

A series of tests made on gages of this material by the Bureau showed that the lengths changed considerably. The gages were hardened to 95 scleroscope by heating to 850 deg. C. and quenching in oil. Cooling a gage that is 0.44096 in. long to —114 deg. C. and returning to room temperature produced an increase in length of 0.00048 in.; but upon cooling again to —135 deg. C. and returning to room temperature, no further change in length was noted. Heating the same gage to 392 deg. C. and allowing it to cool to 20 deg. C. caused a permanent shortening of 0.00124 in. Even at room temperature gages that are 1.0 in. long originally change in length after a few months, one sample increasing 0.000047 in. after a period of one year. Peters and Boyd (Bureau of Standards) have found (Scientific Paper No. 436) that unless the material from which the standards are made is exceedingly stable the high accuracy of the length determination is soon lost due to changes in the length with time.

In view of this instability of the best gage steels, it again becomes apparent why the M-Standard should be periodically checked and safely protected at all times from climatic conditions. The next step is to make the M-Standard.

Two general types may be considered, namely, the gage whose dimension is taken from end to end and the one that is measured between two fine lines ruled on the surface. The former type is by far the easier to make for high precision work. Both Johansson and Hoke (in conjunction with the Bureau of Standards and lately the Pratt & Whitney Co.) have developed processes for making end gages that include errors less than 0.00001 in. on a commercial basis. The Hoke process is very simple, consisting in rotating several gages vertically about their own axis while two very large and heavy circular lap plates are revolving in contact with the ends of the gages. The gages are periodically and systematically interchanged, a careful check being kept on the progress of the very slow lapping. When Johansson was once asked what he used in his secret departments to make the standard gages he answered, "We use lots of patience."

Line standards are more difficult to make on account of the fine lines which have to be drawn. However experts are able to draw lines on platinum or steel finer than can be measured. Lines are usually drawn about 0.00001 in. in width, but of course best results are obtained with the right combination of line width and magnification power of the microscope. A magnification of about 400 will give the best definition with a line about 0.0001 in. in width while a magnification of about 50 will give good results with a line about 0.0005 in. wide. The setting of the lines cannot be done without errors much less than 0.00001 in., although they can be calibrated by direct comparison with the Primary Standard ±0.000004 in. if a large number of observations are taken.

In establishing either the end or line type of M-Standard some method of direct comparison of the

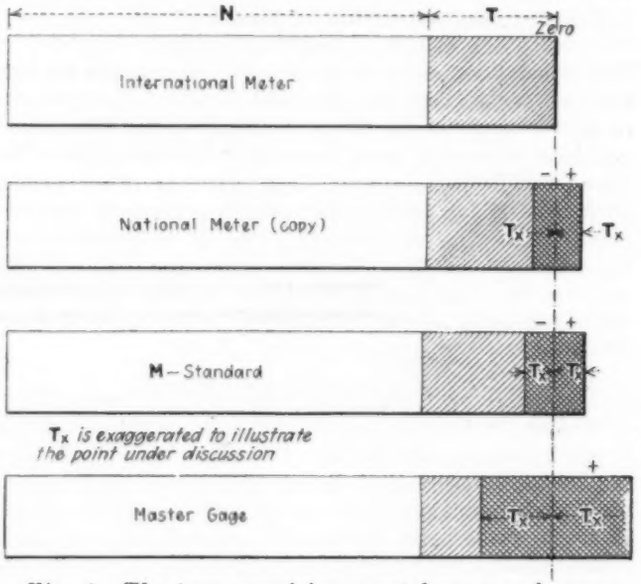


Fig. 2—The term precision must have a reference before it can be defined

uncalibrated gage with the Primary or National Standard in Washington must be used. It need not necessarily be an actual or physical comparison, although this can be done at a very small cost by sending the Standard to the Bureau for comparison.

In the case of an end-type gage the manufacturer may, if he knows how, calibrate his own M-Standard by means of light waves. These waves, in the cases of the red, yellow, and green radiations from cadmium, have been determined by direct comparison with the Standard Meter by Michelson in 1893 and his results were confirmed by Fabry and Benoit in 1907 to one part in sixteen million. Monochromatic light waves consist of a single component of motion (86,500 ft. per sec.) so far as we are aware, which type of motion is constant and unaffected by conditions so far experienced in the solar system.

A material length standard consists of a complicated system of motions between atoms and within the atoms themselves, which are subject to variations due to temperature changes, stress readjustments and all chemical and physical changes which materials are subjected to. The light-wave standard is always available and hence is easy to apply when certain principles are known.

In view of these facts most governments would consider calibrations made with light waves as authentic as are those that are made directly with the International Meter. It is interesting to note that the Bureau of Standards in Washington, D. C., has developed an optical method using light waves as a primary standard with which one person is able to test the planeness and parallelism of the surfaces and length of about 100 gages per day with an uncertainty of not more than 0.000003 in. During one year about 30,000 precision gages were tested at the Bureau by two workers which shows that this same method might also be used by a manufacturer to check his master gages periodically. A thorough description of this method can be found in Scientific Paper No. 436, by Peters and Boyd.

Other Practical Methods Used

Other ultra-sensitive methods have also been developed but they are not as accurate or practical as the light wave method. One of these is the method that detects small changes in the distance between two plates of an electrical condenser, while the other uses the smaller penetrating X-rays whose wave lengths are equal to billionths of an inch as against 0.00002 in. for visible light. The determination of the X-ray wave length is inaccurate as compared with that of light because it depends upon certain hypotheses regarding the spacing of atoms within a material molecule.

There remains one other method of calibrating the M-Standard. That is by purchasing either Johansson or Hoke gages for the purpose. The guaranteed accuracy of these gages can be proved by submitting them to the Bureau of Standards for checking. They may therefore be used as the M-Standard itself, but in such a case the particular gage specified for such a purpose should never be used as a working, inspection or master gage.

An end gage has only one length while a line gage may have many additional points to consider. In the case of M-Standards, however, a line gage may have only two lines or, at the most inch and half-inch subdivisions. To check master gages which may have a variety of uneven lengths some means of easy and precise calibration must be provided. Thus end-measuring machines, end and line comparators have been developed by a very few concerns, such as Pratt & Whitney Co., Brown & Sharpe Manufacturing Co. and the Société Genevoise. The National Physical Laboratory at Leddington, England, and the Bureau of Standards have also developed very sensitive end comparators. That of the latter, an optical method employing light waves as a standard, has been previously described.

The principal requirements of these machines, which constitute the manufacturers' final court in dimensional disputes, are as follows:

1. The various contrivances, both mechanical and optical, used to make the comparison of dimensions lying within the smallest divisions on the M-Standard must not give rise to a known error of more than a given value, in most cases about 0.00004 inch.
2. Under a given set of conditions such as temperature, personal errors, etc., an operator should be able to repeat a measurement.
3. The machine should be self-checking, thus placing all dependence upon the M-Standard.
4. The M-Standard should not be subjected to wear.

Precision Is a Relative Term

As previously stated, precision is the determining factor in the control of the interchangeability system by means of a standard and gages. Precision, however, is a relative term. Depending upon the degree to which it is carried out, it changes progressively from a matter of technique to science and thence to philosophy.

No machine on earth can measure precisely (truthfully), because if the true length of a specimen were to be measured, there would be no means of knowing it. But a machine may have a *degree* of precision or accuracy, which will depend upon the following:

1. How sensitive the machine is made.
2. The extent to which constant errors can be eliminated.
3. The probable error of a single measurement, previously determined from a considerable number of observations, taken by a single observer, under a given set of conditions, after mistakes and constant errors are eliminated.

The probable error and the probable value (arithmetical mean), from which the former is calculated by the method of least squares and a second-degree equation, are strictly theoretical quantities as they are based upon the following assumptions, providing that constant errors are eliminated and observations are made under as nearly the same conditions as possible.

1. That small errors are more frequent than large errors.
2. That positive and negative errors are equally frequent.
3. That very large errors do not occur.

The probable value approaches the true value (which we do not know and probably never will) as a limit. Therefore the degree of accuracy increases with the number of observations or measurements taken, but at a much slower rate after a reasonable number, say about one or two hundred are completed. The probable value being theoretical, it will always contain an error.

Therefore the degree of accuracy of a machine, when stated as for example 0.00004 in. for an end-measuring machine, means that for any single measurement "*A*" of a specimen of about maximum length for the machine in question, the changes are even that the true error does not exceed ± 0.00004 in. providing all constant errors have been eliminated.

It will be noted that the maximum length is specified, because then it is harder to eliminate the constant

errors. For smaller lengths the degree of accuracy for the machine referred to above would be greater. The constant errors for a given machine and the probable error for a single observation of maximum length covers all the errors introduced back to the M-Standard mounted in the machine and when the errors of the M-Standard, as given by its calibration, are applied the measurement is complete back to the Ultimate Standard or International Prototype Meter.

In conclusion it must be repeated that in the interest of interchangeable manufacture, particularly for the future prospects of this very essential principle, all large-scale manufacturers should establish an M-Standard which is at all times in accordance with the National and hence the International Standard Meter. Furthermore the M-Standard should be surrounded with suitable means for readily checking master gages whose lengths are likely to vary widely, seldom being of about the same length as the M-Standard or subdivisions of it, if it has any. The probable error introduced by these intermediate contrivances should be definitely known in order that it may be added to the probable error of the M-Standard itself. In this way all manufacturers will be making articles to dimensions which refer back to the same Ultimate Standards, which is the International Meter. In the next installment of this series the various methods used in checking masters against the M-Standard will be considered in detail, covering all types of end-measuring machines and end and line comparators. The errors and limitations of the component parts of these machines will also be considered.

Where Is The All-Round Mechanic?—Discussion

By E. M. Chase

EVER since Mr. De Leeuw stated in an article under the title given above, on page 851, Vol. 61, of the *American Machinist*, that we did not now need the all-round machinist, there has been considerable discussion of the machine-shop apprentice system. It is strange that after years of dalliance we have not settled down to some definite, logical, or universal plan of providing for this want, if it exists.

We can very safely assume that the majority of machine tool manufacturers need apprentices in order to supply their plants with satisfactory help; and that the manufacturers expect, by means of the apprentice course, to get some material that can be used in an executive capacity; some all-round mechanics, and some who will stick at one branch of the trade and be satisfied to work at that branch indefinitely. Apparently, what is needed is some means of selecting, as promptly as possible, those best fitted to go into one of the three or more classes.

Apprenticeship courses of three or four years are out of date. There was a period not so very many years ago, when the apprentice paid to learn a trade during a period of four years. For the first year and a half, practically all that he did was to sweep out the shop and run errands. After this time, he was advanced to doing such things as spacing gear teeth on a semi-automatic machine by means of an index plate, or stopping some machine for a journeyman before the cut had gone too far. A part of this old scheme, such as sweeping the floor, etc., has been discarded, and it is fair to admit that the substitution of book-learning is an improvement, but there is still the tendency to hang on to the long term of service.

It is my opinion, derived from a good many years' experience, that one year of actual intensive instruction on production work is sufficient to teach anyone mechanically inclined, the average gamut of the machinist's trade. Skill in a trade comes only from extensive experience, and while intensive instruction does not give extensive experience, it does provide more experience than the old plan, and just as many all-around mechanics can be produced.

The instruction should be given in an institution financed, so far as its real estate and equipment is concerned, by concerns located in a mechanical or machine tool center. The institution should be self-supporting. The orders on which the boys would work in this institution, would be supplied by the manufacturers, and the finished product should be charged to the manufacturers at its previous cost to them. This would give an opportunity for obtaining real instruction under the supervision of someone capable of teaching.

The boys who were ambitious and interested beyond trade requirement, would take up studies in their own time, not because they were forced to do so, but because they wanted to advance. Those who wished to be all-around mechanics could be readily enough detected, as well as those whose interest was only in one branch of the trade.

These boys could be apportioned to the various firms in a manufacturing center, in proportion to their investment and the amount of work which they sent to the school. If, at the end of the contract period, there were boys who showed a tendency toward executive or other ability, this tendency could be developed by the manufacturer in his own factory.

The institution would act as a clearing house and would eliminate a large percentage of the loss of time and dissatisfaction always apparent in the present apprentice course.

By this plan, enough help of the various grades could be supplied to take care of all requirements, and the number of boys that could be graduated daily, after the first year, would depend upon the number of applicants and the capacity of the institution.

How I Use the *American Machinist*

By W. H. Wolfgang

When I get my copy of the *American Machinist*, I read it thoroughly, including the advertising pages. Any articles of particular importance or interest I index on 3x5-in. library cards and file them in my cabinet. Next, I take out the wire clips and separate the reading matter from the advertising pages. The reading matter is put into binders that hold one volume, and when each one is full, I send for the index and bind it with its volume. The advertising pages are gone over thoroughly and any matter pertaining to new machines, efficiency in operation, etc., is filed in Shannon transfer cases. Advertising matter not so filed is scrapped.

In addition, I have a catalog file and if I see any advertisements of machines that I want further information about, I sent for the catalogs and file them. I use them in recommending new machinery and tools and find them very valuable.

Automotive Production

Making Chrysler Connecting Rods

By John Younger
Associate Editor, *American Machinist*

Rods are coin-pressed after drop-forging — Ensuing work divided into twenty-five operations—Details of some of the machine work

THE connecting rod is today one of the most vital factors contributing to the smooth running of the engine. On its light weight and accurate balance depend freedom from vibration and ability to reach high speeds easily. It is necessary therefore to safeguard the machining processes so the strength will not be impaired and the weight will be very closely in agreement with a pre-determined standard. This means that dimensions must be very accurate. In fact the wrist-pin hole is held to an accuracy of 0.00025 in. and the crankpin bearing is relatively just as accurate.

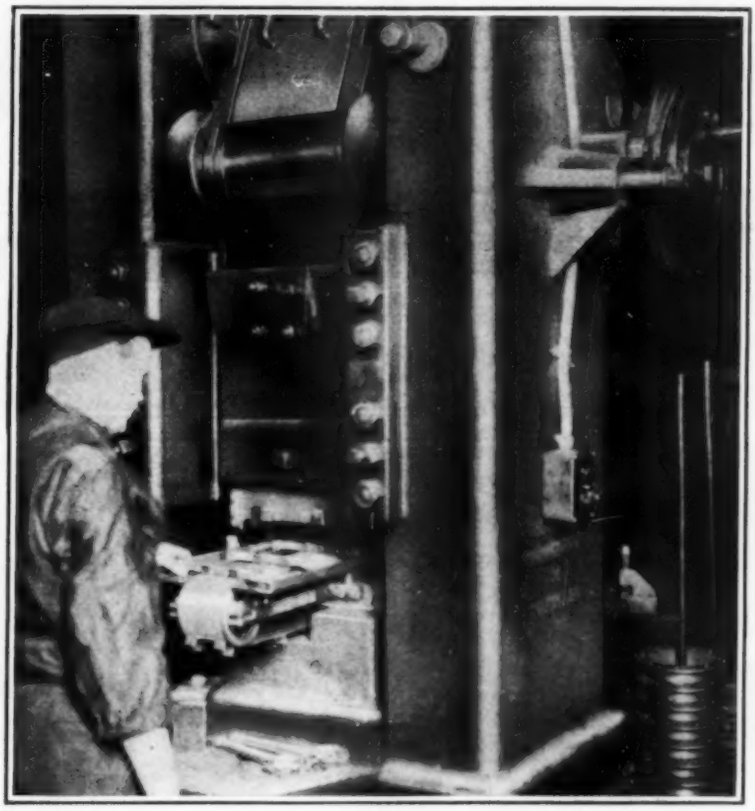


Fig. 1—Coining the connecting rods

The rod is a drop forging of alloy steel heat-treated. It is coin-pressed in a No. 664 Toledo knuckle press and instead of the operator feeding the rod directly under the dies by hand he places it on a tray along whose center runs a miniature conveyor belt operated by the machine, Fig. 1. The belt carries the rods one at a time under the dies where the wrist pin and big-end bosses are flattened to size. This method eliminates any after-milling operations on these faces. The sequence of operations is then as follows:

1—Straddle mill both sides of bolt bosses in a No. 2 Brown & Sharpe milling machine.

2—Drill wrist-pin hole in a No. 121 Baker drill.

3—Ream wrist-pin hole in a single-spindle Leland-Gifford drilling machine.

4—Bore big end in a 20-in. Barnes drill press, Fig. 2.

5—Drill lock-screw hole in an 18-in. Henry & Wright drilling machine.

6—Saw slot in wrist-pin end in a No. 6 Whitney hand milling machine.

7—Counter-drill and spot face lock-screw hole in a two-spindle Henry & Wright drilling machine.

8—Tap lock-screw hole in a No. 2 Garvin tapper.

9—Semi-finish-ream wrist-pin hole in a 24-in. Cincinnati-Bickford drilling machine.

10—Straddle mill bolt bosses and saw off cap in a No. 3 B Milwaukee milling machine, Fig. 3.

11—Drill bolt holes in cap and rod in a 15½-in. Foote Burt drilling machine, Fig. 4.

12—Ream bolt holes in Barnes drilling machine.

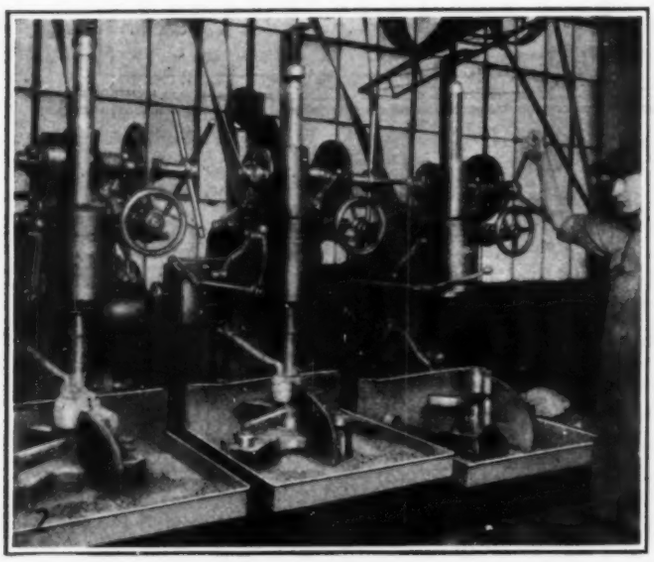
13 — Countersink bolt holes in rods in Allen drilling machine.

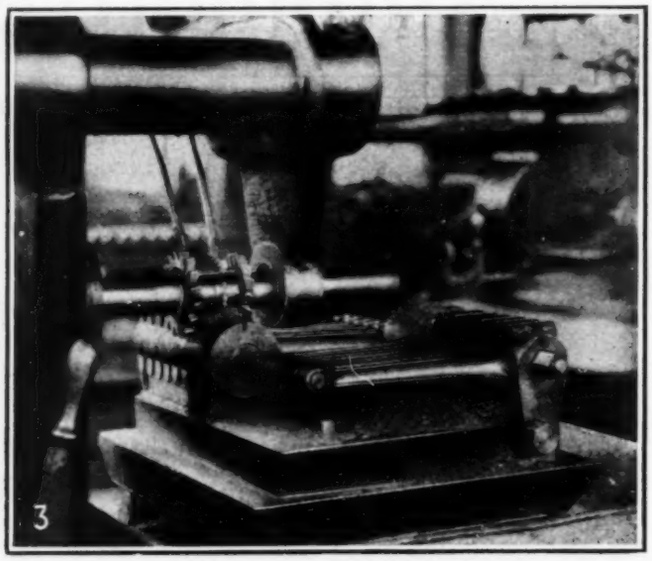
14—Disk-grind face of cap in Gardner grinder.

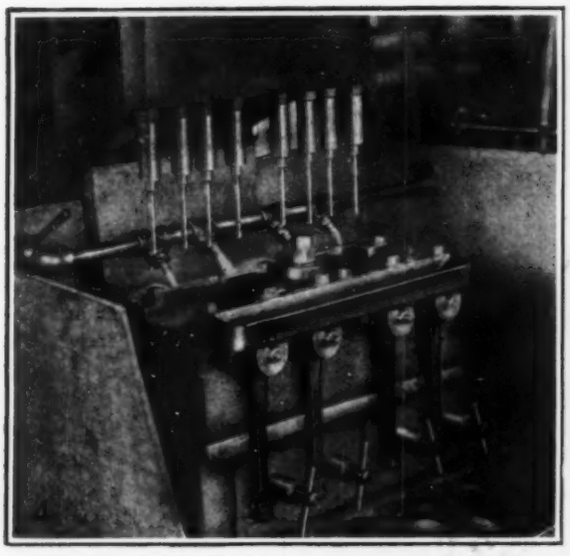
15—Drill crankpin hole in caps in 24-in. Baker drilling machine.

16—Finish-ream wrist-pin hole in 24-in. Cincinnati drilling machine.

AUTOMOTIVE PRODUCTION







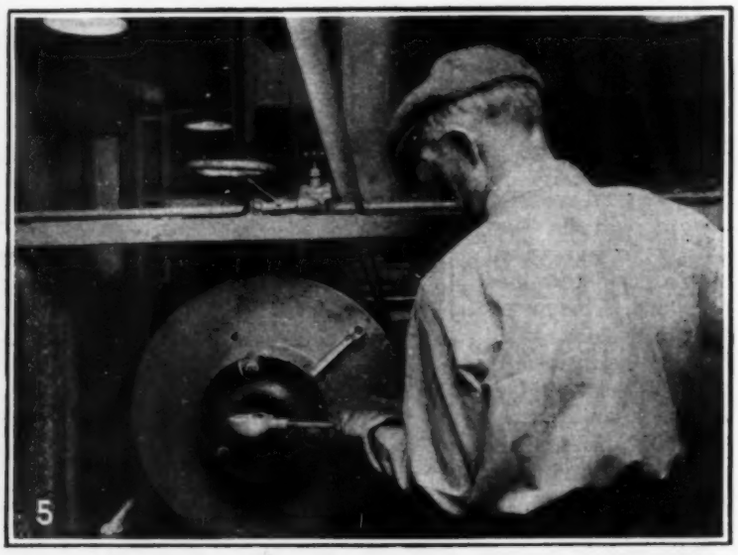


Fig. 2—Drilling the big ends. Fig. 3—Straddle-milling bolt bosses and sawing-off caps. Fig. 4—Drilling bolt holes in cap and rod. Fig. 5—Centrifugal casting of babbitt bearings. Fig. 6—Broaching and burnishing the big end. Fig. 7—Testing for alignment

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17—Chamfer crankpin hole in rod in No. 6 Whitney hand milling machine.

18—Chamfer crankpin hole and cap in No. 6 Whitney hand milling machine.

19—Burr at bench.

20—Assemble cap and rod.

21—Disk-grind sides of cap and rod in Gardner grinder.

22—Inspect.

23—Rod placed in acid bath of hydrochloric acid.

24—Rod cleansed in zinc chloride and tinned.

25—Babbitt poured into centrifugal casting fixture (Fig. 5). After some assembling and minor machining operations the big end is simultaneously broached and burnished, Fig. 6, and tested for alignment, Fig. 7.

Returning now to a more detailed study of some of the operations, the first thing that will be noticed is the fact that all standard machine tools are used, thereby contributing to flexibility and simplicity. Second, a study of the illustrations will show that simple but very rugged jigs are used. This adds to the ease of the operator in getting an understanding of the tools he is working with and also adds materially to the accuracy of the work.

These advantages are indicated in Fig. 2 where the big ends are drilled. The rod is located from the wrist-pin hole and from the cone which projects into the forging recess and automatically evens up the thickness of the metal. The fixture shown in Fig. 3 is an adaptation of the station device to a standard milling machine. After straddle-milling one group of six rods the fixture is swung around half a turn and the second group is worked on while the first is being unloaded and a new lot loaded on. Note in this fixture the rigidity and ruggedness. A similar fixture is shown in Fig. 4, except that the rods are vertical.

The first half of the combined broach and burnisher shown in Fig. 6 is a cutting tool; the after part is a burnisher; and the resultant finish on the white metal bearing is just like a highly polished mirror. The accuracy as stated is about 0.00025 in.

The babbitting fixture in Fig. 5 is simply a means of flowing babbitt under centrifugal force in such a way that it impinges on the rod surfaces with considerable force and produces a very dense, homogeneous bearing.

Drop Forging 600 Tons of Steel Daily

With 89 listed parts for Ford cars, the drop-forge shops of the Ford Motor Co. are using 600 tons of steel per day at present. This output includes 8,000 crankshafts, 7,000 front axles, 45,000 connecting rods and caps, and smaller forgings too numerous to mention. The drop-forge shops occupy a total area of 170,000 sq.ft., taking more than two entire buildings.

The equipment includes 91 upsetting machines, 96 drop hammers and 80 trimming presses. There are also two hydraulic presses having a maximum pressure of 1,000 tons each. The hammers vary from 800 to 5,600 pounds.

In addition to Ford parts, this department also handles forgings for conveyor lines and other machinery used in the plants. It is believed to be the largest and best equipped drop-forging department in existence.

Motor Shop Problems

Noisy Gears and Rigid Crankcases

By Frank C. Hudson

MY OLD friend Charles Logue, in a paper before the A.G.M.A. says that "noise in the operation of gears is usually a direct indication of inaccuracy in spacing or in forming the teeth." This does not agree at all with the experience of some of my other friends, even though it sounds as though it ought to be so, whether it is or not.

Gear noise, as I pointed out in a recent effusion, seems to be more or less independent of accuracy but directly dependent on the kind of surfaces that come in contact. Men who have been tied up with the automobile gear problem for years, tell me that they have had poorly spaced and incorrectly formed gear teeth run very quietly while the best gears, from these points of view, were too noisy for closed car work.

What seems to count is the smoothness of contacting surfaces. Slight unevenness in the surface of the gear will produce an incipient chatter that starts vibrations, and vibration means noise, especially when the gears are mounted in a very light box like a transmission case. Two or three pounds of metal, properly distributed in the walls, and in bracing a transmission case, will probably do more to make gears run more quietly than dollars spent in fussing over the last millionth of an inch in extreme accuracy.

Along this same line is the question of stiffening engine crank cases. We've been skinning the weight down until, in some cases at least, we've gone beyond the economical limit. As is frequently the case, we've saved weight in the wrong place.

When we consider the size of the wallop the crankcase gets at every explosion, and that it gets a little million of them before we've run many miles, we can realize that it has a real, man-sized job on its hands. Of course, they stand up remarkably well, but it's dollars to doughnuts that the crankcase "weaves" with every wallop and that means loss of energy and unnecessary wear on the bearings.

Just to show that this isn't all imagination on my part, I'll cite the case of a new model car that came out this year. For some reason, unknown or otherwise, they stiffened up the crankcase. Furthermore they had the good sense to test out an old engine with the new crankcase and without other changes. It not only ran more smoothly but it actually developed an appreciable increase in power. In other words, the power that was being used to deflect the crankshaft in the light crankcase was being utilized as useful work in the new motor. It's more than likely that the same treatment might help reduce gear noise.

If some bright engineer will design a transmission case primarily to eliminate vibration, putting in ribs or braces so as to prevent weaving of the shafts carrying the gears, he may find that he has accomplished several desirable things. It is just possible that such a case would permit the use of gears that are now rejected for noise, and save money in several ways.

AUTOMOTIVE PRODUCTION

Abstracts

from other publications

Using the Centerless Grinder

W. L. Carver describes the increasing use of centerless grinders, not only for plain parallel cylindrical parts but for formed and taper parts. The first variation from the so-called "straight through" method which produced plain cylindrical parts, was the shoulder method, in which parts such as engine valves and valve tappets were fed in against a stop or placed in position between the wheels for the grinding of the stem or barrel diameter.

Recently several new possibilities have been developed and such parts as ball ends, taper shanks, formed surfaces are now being handled on an excellent production basis. The work described in this article is produced by a Cincinnati centerless grinder.

Mr. Carver states that in one case where 0.012 in. stock is removed from pins $\frac{3}{4}$ in. diameter and 3 in. long, the production rate for finished pieces is 195 an hour. Pins of $1\frac{1}{2}$ in. diameter and 6 in. long have been produced at a rate of ninety finished pieces an hour, where 0.020 in. stock was removed. Small disks of $\frac{1}{16}$ in. thickness and $\frac{1}{4}$ in. diameter are being ground to size within 0.0002 in. at the rate of 8,500 pieces an hour. The production rate of mushroom valve tappets for grinding is given as follows—with hardened steel as the material and a finish allowance of 0.01 in., tappets having barrels of $\frac{3}{8}$ in. diameter and $2\frac{1}{4}$ to $2\frac{1}{2}$ in. length have been finished to limits of 0.0002 in. at the rate of 375 pieces an hour. Similar illustrations are given for shackle bolt and ball struts and there are many photographs accompanying the article.—*Automotive Industries*, May 7, p. 821.

Cadillac Foundry

Fred L. Prentiss describes the two independent systems of sand preparation and distribution, one for coarse sand and one for fine sand, that are provided in the iron foundry, there being duplicate mixing units at either end of the plant under the roof. The shape-up sand passes through the grating to belt conveyors, which deliver it to a main belt conveyor having a magnetic pulley for removing gaggers, spikes and other metal. It is then elevated and goes through a riddle that dumps it into a screw type mixer for tempering; from this it is delivered to a Rapp revivifier. From the latter it is fed to a belt conveyor that empties into several storage bins with an aggregate capacity of 80 tons. Sand for the cylinder molding floor is delivered to the hoppers above the machines on a belt conveyor from the storage bins of one unit.

There are many photographs accompanying this article and a description of the aluminum and brass foundries, the pattern storage building and heating and ventilation of the buildings.—*The Iron Age*, April 23, p. 1199.

The Use of Acetylene in Automotive Repair Work

B. M. Ikert writes on the special value of acetylene gas for brazing and soldering work. In both brazing and soldering jobs heat is the essential element and the more quickly it can be applied and regulated to the particular work in question, the better the results, other things being equal. In the automotive shop the occasional jobs calling for soldering or brazing are quickly and economically handled with an outfit comprising a set of torch heads which can be used in connection with a tank of acetylene gas. Some torches for acetylene are used with compressed air to furnish what is called a brush flame and needle flame.

These are illustrated. The gas is supplied by an tank and the air by a foot bellows, storage tank, garage air line or air compressor. The air pressure is usually not over 1 lb. according to the needle flame required. The gas consumption is usually about 1 cu.ft. per hour at 5 lb. gas pressure. The brush flame has a temperature of about 2,800 deg. F., and the correct flame at 5 lb. gas pressure shows a bright, sharply defined inner cone about $\frac{3}{4}$ in. long and a pale blue brushy outer flame about 3 in. long.

The needle flame is especially well suited to soldering radiators in such places as the core, where the use of a soldering copper is out of the question owing to its size. The copper wire for brazing purposes should not be over 0.010 in. thick and should be wound closely and evenly around the part to be brazed.—*Motor World*, April 2, p. 22.

Machining the Brake Spider

The brake spider on a 2-ton worm drive truck axle is a malleable iron casting weighing about 25 lb. It costs 24 cents to machine it complete and it takes $21,500 worth of machinery and tools to complete the process.

The casting is first put into a specially designed electrically operated chuck on a semi-automatic turret lathe, where the inside of the barrel is bored and reamed and the inner face turned. There are three operating heads on the turret. The first rough bores and turns, the second finish bores, and the third reams. This special machine with tools and fixtures cost $3,000. The second operation is facing and turning to opposite end of the barrel on a machine involving an investment of $2,500. Next the four bosses at the outer points of the spider are milled on both sides. The machine has two opposed fixtures, the operator sets up one piece while another is being machined. This equipment cost $3,400. Operation No. 4 is the drilling and reaming of the two pin holes and two camshaft holes, done on a large multiple drill press, using a massive fixture.

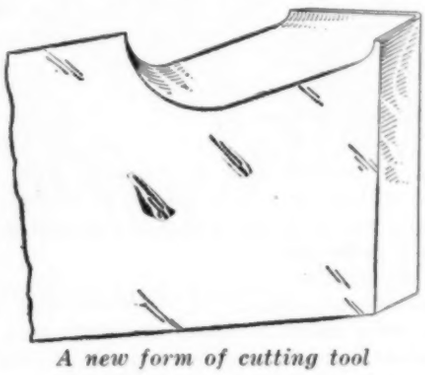
One group of four spindles drills the holes and the work is then moved over to the other end of the rails, where a group of four reamers complete the job. This equipment cost $8,000. The next two operations are drilling the rivet holes and tapping the oil holes, requiring an investment of $4,100. Finally the checking fixture for inspection is used, and because of its great accuracy this fixture cost $500.—*The Timken Magazine*, April, p. 470.

Recent Investigations in Turning and Planing and a New Form of Tool

By Dr. Hans Klopstock

Measuring power consumption — Tools used for tests — Formation of chips — Action of cutting tools — Results of new form of tool—Forging and grinding tool to shape

WITH the increasing wages, the problem of efficient tools and working methods becomes of ever-increasing importance. Scientific investigations, covering turning and planing, that have been carried on during a period of two years in the machine-tool laboratory of the Polytechnic Institute of Berlin, have resulted in improvements that have shown themselves to be of material economic value. It was believed from the start that a study of this character could lay claim to scientific accuracy and absolute dependability only if every mechanical measurement made could, in some manner, be instantly checked. The only way this seemed possible was by the measurement of the power of the driving motors, requiring a complete knowledge of all the characteristics and losses of the machine tool used. The cutting tests were therefore preceded by a most thorough study of the lathe on which the tests were conducted and all the electric meters, gages, and other measuring devices used were checked as to their behavior under all possible conditions.



A new form of cutting tool

The lathe used in these tests has a swing of 18 in. and a distance between centers of 118 in. It has five spindle speeds and a 50-hp. driving motor that can be varied to give speeds from 7 to 820 r.p.m. The feed gear has eight speeds, permitting feeds within the limit of 0.0037 in. and 0.1 in. per revolution. A separate 5-hp. motor was used for driving the feed mechanism. The tool support used divided the total pressure on the tool in three components, a vertical, a surfacing and a traversing component. The tools were accurately set to the center height, in which position all measurements checked within $\pm\frac{1}{2}$ per cent. A recording gage was connected so that all three components were recorded at the same time, showing the motor input in such a manner that both motors could be started and stopped together. The power consumption of the feed gear, running idle, was determined at each gear ratio and with different motor speeds. A prony brake, with a cast-iron disk mounted on the faceplate of the lathe, gave exact data with regard to the relation of actual power developed on the faceplate and electrical input. In order to have a ready check on the accuracy of all readings, a set of curves was designed to show the relation that existed between the readings of the ammeter and the indications of the gage. The use of these curves recorded any error that might occur, eliminating a waste in time by further tests on the basis of defective equipment or erroneous assumptions.

A tabulation was made showing the tests conducted on different materials, wrought iron, cast iron, and chrome-nickel steel, with three forms of tools, using various cutting speeds and many chip sections. This tabulation was aimed to determined the influence, upon the cutting forces, of the cutting speed, the chip section, the shape of the tool and the characteristics of the materials. The tools used were the Becker tool, such as was used by Schlesigner and Kurrein in their tests in 1913 to determine the life of tools, having an angle of 68 deg., considered favorable by Taylor; the Siemens tool favored by some manufacturers and having an angle of 60 deg., and the side tool, having an angle of 70 deg. at the point, capable of resisting destruction under severe conditions. With all these tools there is a tendency for chip pressures to decrease slightly with increasing cutting speeds, agreeing with the conclusion reached by Taylor and by Nicolson. Tests made at 197 ft. per min. showed only slight decrease in pressure as compared with tests under similar conditions at 59 ft. per min.

Before proceeding with the influence of the chip section and of the form of tool, the difference between the nominal section [depth of cut $\times$ feed] and the actual section removed was noted. The relation between the two depends on feed, depth of cut, form of tool and angle under which the tool is applied. Assuming that the shaft had previously been turned with a small enough feed so that its surface was practically smooth, it will be apparent that the chip removed is smaller than its nominal cross-section. The actual area removed may be expressed in percentage of the nominal chip section and a curve was drawn giving this percentage on the basis of a certain tool, a certain angle of application, and a certain feed. The curves indicated that with the larger feeds, the percentage

Abstract of a paper presented at the Spring Meeting of the American Society of Mechanical Engineers, Milwaukee, May 18 to 21, 1925.

of actual section removed becomes smaller, other things being equal. The curve also showed that with greater depths of cut, the sections removed become larger in relation to the nominal section.

In an attempt to reduce the chip pressures to a formula, the method adopted by Meyer in 1908 was followed, in drawing the Brinell hardness curves on double logarithmic paper, using as the abscissa the area of the Brinell impression and as the ordinate, the pressure applied. Similar curves were made with the vertical component of the chip pressure as ordinate, and the actual cross-section of the chip as abscissa. The curves under the circumstances become straight lines, the same as the curves drawn by Meyer. This at once suggested a comparison of the two sets of curves for the three materials used in these tests. When the hardness curves were added, it was found that they formed a larger angle with the axis of abscissas, and that they intersected with the chip-pressure curves. There is a noted difference in the relative location of the Brinell hardness curves and of the three chip-pressure curves. The Brinell curve for cast iron is between those for chrome-nickel steel and wrought iron, while in the case of the chip pressure, the curve for cast iron is considerably below both of the other two curves. This shows that cast iron, notwithstanding its great hardness, is comparatively easy to work on a lathe or planer.

The Process of Metal Cutting

The actual formation of a chip has been studied but little, with the result, that rather vague ideas still prevail regarding this fundamental operation. A clear observation of a turning tool working on a lathe is practically impossible, since, during the process of turning, the point is imbedded in the material to such an extent that the exact action of the tool cannot be seen. Therefore, it was decided to use a shaping machine and a piece of work that was finished on one side, so that all fissures and compressions of the material could be well observed. As it appeared desirable to examine individual phases of the process, a planer was later substituted that was hand-operated so that it could be stopped at any point desired. At first the point of the tool compresses a small quantity of material, then, this compression continues so that a large tear is caused between the main part of the work and the chip. This tear extends from the point of the tool to a point on the surface of the work, a small distance in front of the tool. In continuing, this process repeats itself and small fissures are noticeable under the point of the tool.

In order to show that chips in turning and planing have the same characteristics, both kinds were photographed in plan and side view. The similarity of both chips leaves no doubt that the process in turning is the same as that in planing, notwithstanding that the two chips were taken at different cutting speeds. The surfaces from which the chips were cut also show similar appearance. The cutting edge of the planer tool used was inclined at an angle of 5 deg. to a line vertical to the direction of motion, and the fissures in the corresponding surface showed a similar direction.

From what has been said, it would seem that the process of cutting might be divided into four parts: First, the initial compression of material in front of the tool. This action causes the tool to get its first grip on the work after a chip has been broken off. Second, a slight initial tear, caused between the main part of the work and the material that is to form the next chip element. Third, the material that is to form the next chip element, compresses and bulges on the lip surface. Fourth, a tear, caused between this material and the main work. This tear is not generally complete, but with the exception of cast iron and similar materials, a certain connection remains between the individual chip elements. This connection makes of the individual elements broken off a chip. The conception outlined, explains the oscillating form of chip-pressure curves obtained by Nicolson and others. In these curves the points of maximum pressure represent the moment of maximum compression of the chip elements, while the lowest points succeeding the points of maximum pressure, represent the moments after the chip elements have been broken off.

Effect of Chip on the Tool

Aside from the effect of the turning process on the cutting edge proper, consisting mainly in destruction by impurities contained in the material, there is a gradual effect of the chip on the tool that in time affects the cutting edge. This last action differs from the former as it does not start at the edge but on the lip surface, a slight distance back of the edge, causing a cavity that in time becomes larger, extending toward the rear but slowly approaching the cutting edge. When it comes in contact with the last, the cutting edge is completely broken. This is most noticeable with heavy chips, but even with a small chip section it can be observed, especially when turning a material of great toughness. The lip surface of a tool used for chrome-nickel steel, shows that the cavity begins about $\frac{1}{8}$ in. back of the cutting edge, but that the edge itself is not injured. This action is a result of the compression of the chip element in formation, and of the friction between the chip and the lip surface on which it slides. With larger chips, the effect becomes even more marked and the distance from the cutting edge, at which the cavity starts, is slightly increased. With wrought iron this effect is less and with cast iron it is not noticeable.

A New Type of Cutting Tool

As a result of these observations a form of tool has been designed that is intended to reduce to a minimum the amount of compression and deformation of the chip and the cup action on the lip surface coincident with it. This form of tool embodies the depression in the lip surface that is produced in time by the chip. The expensive and detrimental work of the chip on the lip surface is held to a minimum, and the compression of the chip reduced materially. The tool shown has a front and rear cutting edge, and has along both of these cutting edges a narrow raised section projecting above the rest of the lip surface. The connection between the depressed section and the raised strip is made by a fillet, with the result that the cutting edge has a strong support and that the heat is efficiently carried away from it. The lip angle is generally chosen in the neighborhood of 70 deg., also favorable to the conduction of the heat away from the cutting edge proper.

The characteristics outlined permit higher cutting speeds or larger chip sections, or both, than is practiced with other tools. As a result, production is increased without straining a machine tool, since the chip pressure is not increased and that with the same

size of chip, the chip pressure is reduced so that even a higher cutting speed will not mean greater power consumption. Tests have been made with different chip sections in order to test the working qualities and the life of this cutting edge. The results obtained varied with conditions, but as an average the vertical component is reduced about 26 per cent on chrome-nickel steel and 14 per cent on wrought iron. The transverse force is reduced at an average of about 65 per cent and the surfacing force 60 per cent with chrome-nickel steel and 50 per cent with wrought iron. The difference between the vertical component and the total chip pressure is about 2 per cent.

Formation of Chips

A difference exists in the exact saving of power consumption with different chip sections. When a considerable amount of metal is taken off by the rear cutting edge, the material flowing over this rear edge meets the material coming from the front cutting edge and a certain amount of interference takes place. A chip section that causes metal to be cut almost entirely by the front cutting edge will allow the chip to flow freely without interference. The chip sections of great depths and small feeds show a greater saving than those of small depths and large feeds. Chips are at first produced with a large radius, gradually decreasing as the cutting edge is affected, until a long helix of small radius appears. This shape of chip continues until the tool has become dull, noticed by the chattering noise. With the same depth of cut and feed, the chip produced by the new tool has a smaller cross-section than that produced with the standard tool, due to the reduced compression and deformation. In the latter case the chip runs off at a correspondingly higher speed. The chips produced by the standard tools are of dark color while those produced by the new tools, under the same conditions, are light in color. The difference in temperature has been found to be as much as 100 deg. Centigrade or 180 deg. Fahrenheit.

Life of Tool

An important point with any tool is its life. A large number of tests were made to determine the relative life of the new and standard types of tools. It was found that, under the same conditions, the new tool lasted much longer than the standard tool, that no doubt is a result of the combination of a large lip angle with a reasonably low temperature in operation. The new tool has a cutting edge, mechanically strong on account of its lip angle, that remains reasonably cool, first because the heat produced is less, secondly, because the design of the tool does not interfere with efficient conduction of the heat from the cutting edge. The manner of producing the new form of tool has been given careful study. Complete tools, or cutting tips for the welding to shanks, are made in dies by hammering or pressing. If made in this manner, the tool need only be ground along the narrow raised strip and on the clearance surface. The depressed part of the lip surface is in this case left untouched. In normal operation the cutting edge can be reground four times, after which it must be newly forged. If it is desired to produce the depression in the lip surface entirely by grinding, this can be done by means of a special attachment fitted to a grinder, equipped with a small grinding wheel.

Figuring Labor Turnover

By Alfred Watts

THE company with which I am connected is not satisfied with its figures on labor turnover, particularly when the manager of some other company boasts of turnover percentages very much lower. It is probable that the reason for the discrepancy is a difference in the formula used for making the computation. If so our accountants ought to know about it so that their figures can be made more favorable if possible.

It has been their practice to prepare these statements in two different ways: first, based on the number of people who left their employ in any given period and second, based on the number who were hired during the same period. They consider that the figures obtained by the first method are more significant when the period they cover is one of normal or unusual industrial activity when it is difficult to obtain and hold labor, while on the other hand, the figures obtained by the second method are of more value during a period of business depression when labor is plentiful but new hands are hired only in sufficient number to maintain an organization for a limited output.

The actual computing of the percentages is simply a problem in arithmetic. The number of people hired or terminating their connection with the company during the period considered, as the case may be, is divided by the average number of hands on the payroll during that period. All figures for a fractional part of a year, such as a quarter or single month, are reduced to terms of a full year, so as to have them on an equal basis for comparison. For example, in computing the percentage for any one month, the number of people who left or were hired is divided by the number of weeks in that month and then multiplied by the number of weeks in the full year. This result is divided by the average number of hands on the payroll to obtain the desired percentage. The following arbitrary figures for a four-week period show a typical calculation:

$$\frac{\frac{300}{4} \times 52}{6{,}000} = 65 \text{ per cent}$$

If readers of the *American Machinist* who know of better ways of figuring labor turnover or who can show where the method described is at fault will write a discussion of this little article, their efforts will be very much appreciated.

Promotion Through Suggestion Boxes

"Suggestions also often lead to finding talent and ability for bigger jobs," stated Gerard Swope, president of the General Electric Co., Schenectady, N. Y., at a recent industrial meeting. "This is one of the most difficult and elusive parts of the problem of management—finding the exceptional man. It is a very widespread problem, but pressing in any large organization.

"But probably, the most tragic waste of all in industry is unemployment, where men ready, willing and able to work, are unable to secure employment, and where society really needs their work. The most severe test of any social system is the consideration it gives to the human being, and our present system must find a solution of this great human problem."

Industrial Property Report of International Chamber of Commerce

AN INDUSTRIAL property report has been published as a supplement of No. 4 of the *Journal* of the International Chamber of Commerce.

The Industrial Property Committee was formed in 1922 as the result of a resolution adopted at the London Congress recommending the creation, under the auspices of the various National committees, of special commissions for the study of the best means of repressing unfair competition and for protecting industrial property rights.

The supplement contains the following reference to patents and designs: "The committee has also recently dealt with the subject of patents and designs. It is well known that under the convention any person who has applied for a patent in one of the contracting countries is entitled to a priority period of 12 months within which to apply for protection in the other countries. But for the establishment of a system of priority no security would be possible, because the publication of the invention in one country would otherwise in itself invalidate any subsequent application abroad. Furthermore, in the absence of priority there would be no means of preventing any unscrupulous competitors from stealing an invention and applying for a patent in his own name.

To Protect Priority Rights

"One of the chief difficulties, however, has been that in some foreign systems of law the protection obtained under the priority section has been considerably qualified as the result of legal decision. The committee recommended an amendment of the relevant provisions of the convention with a view to ensuring that priority rights shall be absolute.

"In default of special legislation, the use on board a vessel of an invention protected in any country becomes an infringement of any patent granted in respect of it as soon as the vessel comes within the jurisdiction of the country granting the patent. The committee recommended the insertion in the convention of a clause exempting vessels from the rigorous application of this principle. A form of procedure was also suggested whereby uniformity might be obtained in regard to the documents required in connection with the acquisition of patent rights in all countries.

"With regard to designs it was impossible to make much progress owing to the existence of two opposed schools of thought, one being in favor of the assimilation of the laws of design protection with the laws of copyright, the other insisting on the maintenance of a system of registration. The discussions which took place have, however, been extremely useful, and resulted in dissipating a number of pre-existing misconceptions."

The following report is made in regard to trade marks and unfair competition: "At Washington in 1911 a new article was inserted in the convention of the Union providing that each country should assure to those who enjoyed the benefits of the conventions 'effective' protection against acts of unfair competition.

"It was agreed by all members of the committee that a general clause of this nature was quite insufficient, and that it was highly desirable to insert in the convention general principles which would serve as a guide to all countries as to the specific acts which should be treated as coming within the definition of unfair competition. The committee decided therefore to undertake the task of defining what was meant by 'unfair competition.'

"It was agreed in the first place to insert a clause providing that all acts calculated to mislead the public and to cause it to adopt a particular product or to deal with a particular trader, all acts amounting to trade libel, acts inducing a breach of obligations arising under a law or contract, and all acts generally contrary to law, commercial usage and equity should give rise to an action at the suit of all parties aggrieved. An obligation was also placed on all the contracting states to repress and prohibit the importation, sale or offering for sale of all products bearing upon themselves or their usual get-up or wrappings, any marks, names or devices which would be calculated to convey directly or indirectly a false indication of the origin, quantity, nature or specific qualities of the products or merchandise.

Fraudulent Advertising

"In a further clause it was provided that the prohibition should extend also to false trade descriptions whether they were applied to the goods themselves or were contained in advertisements, brochures, circulars or posters, invoices, certificates of origin or even in verbal communications. The effect of a clause of this nature will be to provide a remedy in most of the cases of unfair competition to which the attention of the committee has from time to time been called.

"Another clause suggested by the committee deals with the cancellation of improperly registered trade marks. Hitherto, especially in countries in which registration is the test of ownership, foreigners have been provided with no remedy in cases in which their marks have been fraudulently registered by unscrupulous foreign competitors. Special provisions were adopted to remedy this state of affairs, and if the proposals of the committee are accepted at the Hague conference, it will be open to foreigners to apply at any time within 5 years for the cancellation of the registration of pirated marks.

"Special steps have also been taken with regard to the use of false indications of origin. Hitherto no country has been obliged to prevent the use of a false indication of origin unless it were coupled with a fictitious trade name or unless it were shown that it had been used with intent to defraud. It was decided to remove this limitation and to provide that each country should by means of seizure or otherwise prevent the importation into the country or the sale in the country of goods bearing any marks or other indication which might directly or indirectly mislead the public as to the true origin of the goods.

"Provision was also made for the institution of penal remedies in cases of fraud and for the introduction in all countries of legislation permitting actions by associations in all cases of unfair competition.

"Minor amendments of the convention were also agreed upon with regard to the institution in all countries of a uniform period of duration of 20 years for trade marks and for the publication in all countries of a gazette containing a facsimile of all trade marks applied for in those countries."

Operations in the Cotton Belt Shops

By Howard Campbell

Uses of modern equipment in the St. L. & S.-W. shops at Pine Bluff—Some practical ideas in home-made equipment—Labor-saving methods

WHILE the shops of the St. Louis & South-Western Railway, at Pine Bluff, Arkansas, are not large shops, the equipment is first-class and some of the methods in use there could be applied to advantage in shops of larger capacity. The uses of the milling and grinding machine are well understood and the better finish and greater production possible with these machines is taken advantage of whenever possible. One of the jobs done on the milling machine is that of milling the four sides of the rear-end main-rod brass, which is finished, floor to floor, in 35 minutes. The piece is clamped to a rotary table, one side is milled, then the table is turned 90 deg. and another side is milled, this process being followed until the piece is finished. Shoes and wedges are also finished inside and out at one setting, a double fixture being used on each end of the table. It is estimated that the job is done in less than half of the planing time. Rods are blocked out and channeled in a No. 4 Milwaukee milling machine, a pair of 9x1½-in. cutters being used to finish a 3-in. channel.

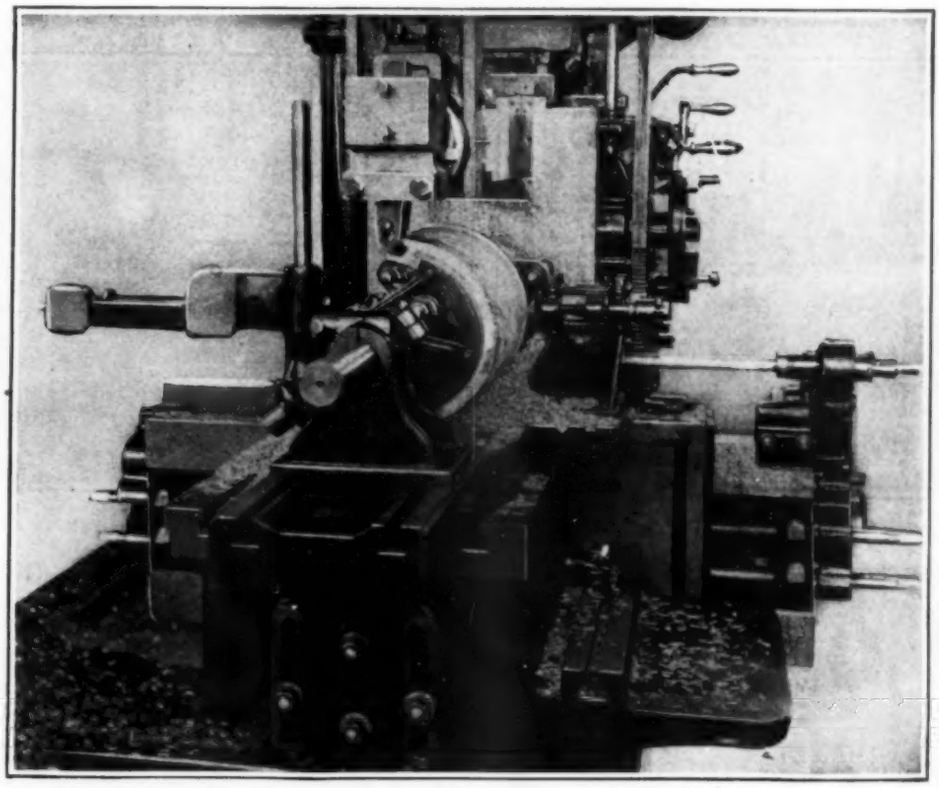


Fig. 1—Turning groove in journal brass

Journal brasses are finished on a Morton draw-cut-cut shaper, shown in Fig. 1. The piece shown in the machine in the illustration is revolving at a speed of 27 r.p.m. while the tool, shown at *A*, is turning a groove under the collar at the end of the piece. The groove is cut, the piece is shaped to the desired radius and is fitted to the box complete in about 27 minutes.

Links are ground on the Gisholt radius-grinder shown in Fig. 2. This is a horizontal machine, with all operating levers within easy reach of the operator. An Aloxite 40-M wheel is used, running at a speed of 5,000 r.p.m., while the arm oscillates 60 times per min. The grinding wheel oscillates longitudinally, also, so that it will wear evently and grind a flat surface. The machine can also be used as an internal grinder for grinding the holes in valve motion parts, side-rod bushing holes, air pump cylinders or any part not over 16 in. deep.

While a number of attchments for turning the bearings on tumbler-shafts have been described in the *American Machinist*, Fig. 3 shows an attachment that is somewhat different in construction from those previously described. The shaft is located between the centers of the lathe, and the tool is carried on the side of a gear mounted in a bracket attached to the lathe carriage, as shown. But before the piece is put into the machine, a large gear with a thread of the correct pitch cut in the hub, is screwed onto the spindle-nose and a bracket, carrying a pinion that meshes with the gear, is clamped in position on the bed, as shown in Figs. 3 and 4. The gear that carries the tool is made in halves so that it can be placed around the bearing and then bolted together, and is made integral with a sleeve that runs in a large bearing and thus keeps

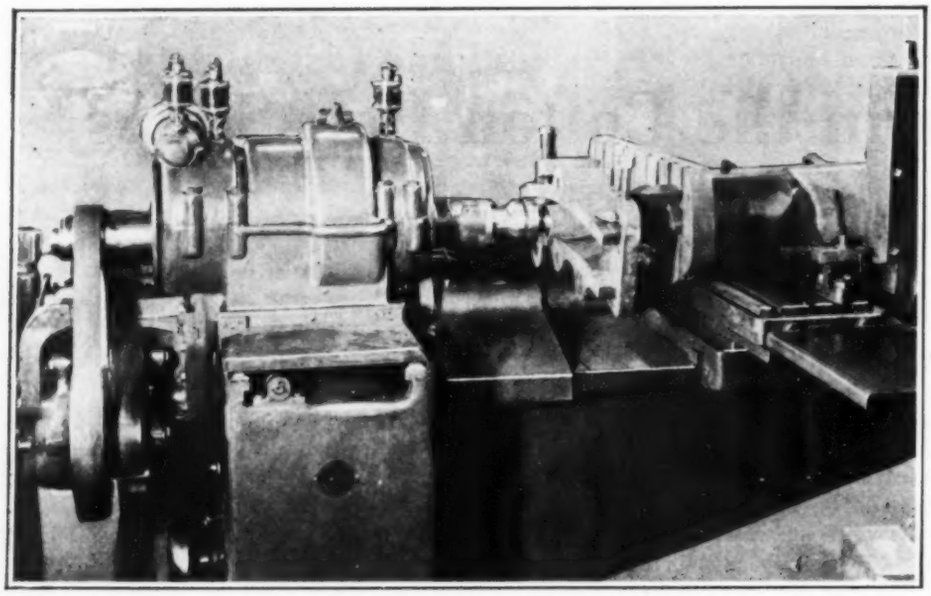


Fig. 2—Gisholt link grinder in operation

to the pinion which meshes with the spindle gear, and which passes through a square hole in the pinion that drives the tool gear. This arrangement does away with the necessity for extra countershafts and belts and works very efficiently.

The practice of threading knuckle-joint pins for nuts has been discontinued on the Cotton Belt road and the pins are slotted for keys, as shown in Fig. 5. The pin is made with a taper of $\frac{3}{4}$ in. to the foot and is seated firmly in the key-slot. To further insure its remaining in place, a setscrew is located in the side of the pin as shown. The use of keys makes it easier to assemble and dis-assemble

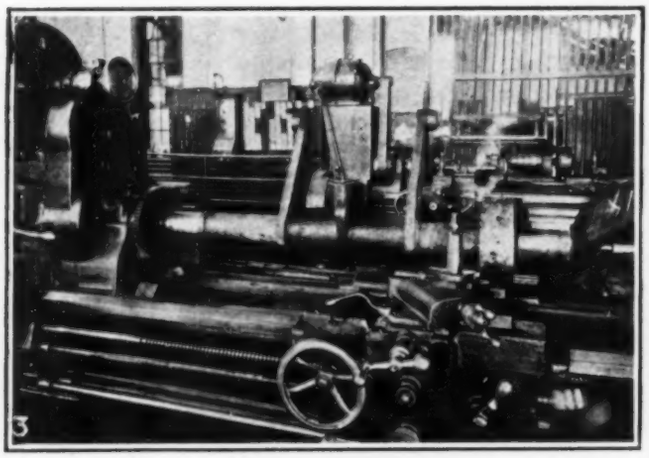


Fig. 3—Turning bearings on a tumbler-shaft.

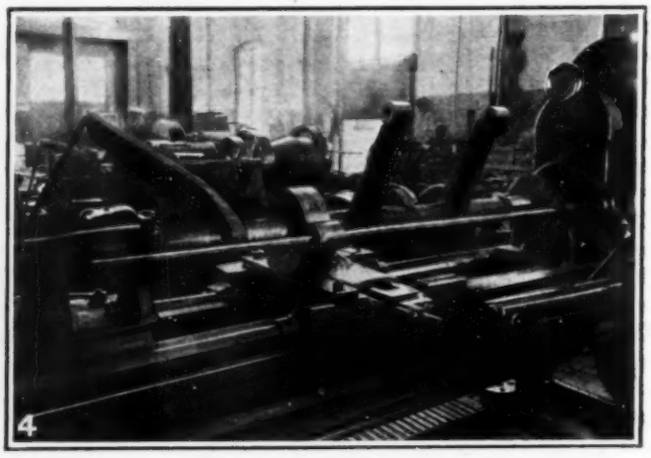


Fig. 4—Rear view showing square shaft

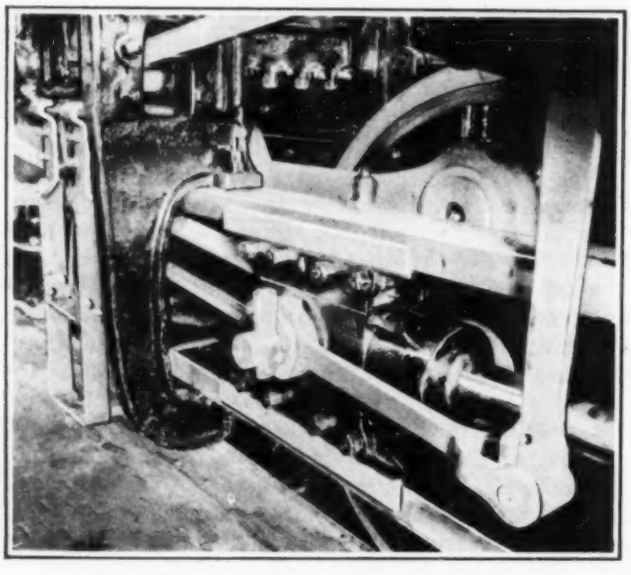


Fig. 5—Knuckle-joints are keyed

the gear in place. The gear meshes with a pinion that is also carried on the bracket on the cross-slide, power being delivered to the pinion by a square shaft attached to the locomotive and although keys have been used in this position for a period of over fourteen months, a key has never been known to work loose.

Cylinders are bored with an Underwood re-boring tool which is operated by a home-made air-motor, as shown in Fig. 6. The cylinders are 5 in. in diameter and the length of the stroke is $5\frac{1}{2}$ in. The gear ratio is 3 to 1.

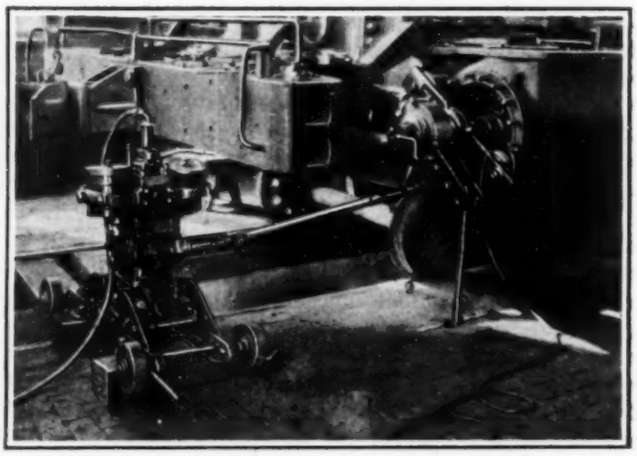


Fig. 6—Home-made air-motor

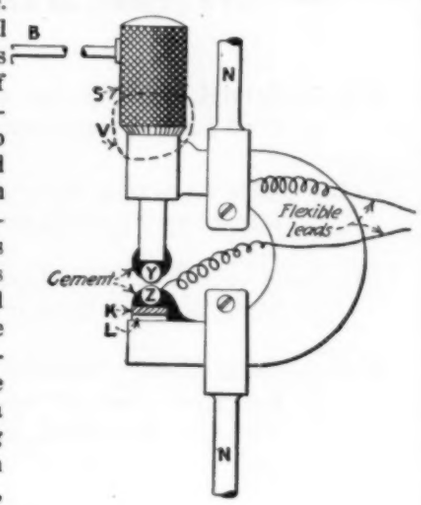
A Quick-Acting Dynamometric Contact Spring

By F. J. Schlink

THE quick-acting dynamometric device shown may be termed a force-increment recorder and its purpose is to devise a means of making an electrical contact so as to record in an oscillograph, without time lag, the instants of the inception and cessation of the lifting force on a vertical sliding rod carrying a number of brushes traversing a bank of contacts.

The first method of attempting this measurement, made use of an overfilled microphone button, modified by substitution of sheet-micarta rings for the mica-insulating rings at each end, and by increasing the amount of granular carbon contained, a change necessitated by the use of the button with its axis at 90 deg. to its normal position. This arrangement proved sensitive, but afforded little or no control of the force end-point at which contact should occur.

The following device was then assembled for opening the circuit to the oscillograph at the instant of cessation of up-drive force. The principal structure of this device consists of a micrometer caliper introduced into the vertical rod *NN*, through which the switching mechanism is lifted. This rod is cut and supplied with suitable clamps for the purpose. Primarily the caliper is used as a stiff spring having a high natural frequency, so that when it is deflected by change in the load on rod *N*, it will move toward its new configuration in a period of time quite negligible in comparison with the lag that is to be determined in the magnet and linkage.



Electrical-contact dynamometer using screw micrometer

To the moving tip of the micrometer screw, and exactly on the axis of the screw, is affixed by suitable cement a well polished steel ball *Y*, of the sort used in ball bearings; to the fixed anvil of the micrometer and likewise in line with the axis of the screw, is affixed an identical ball *Z*, but this second one is electrically insulated from the micrometer frame by being cemented to an insulating disk *K*, secured to the anvil *L*. A fine flexible wire is connected to the micrometer frame and another to the ball *Z*, the last most easily by butt-soldering at a low temperature, or by the conducting cement used in the manufacture of incandescent lamps.

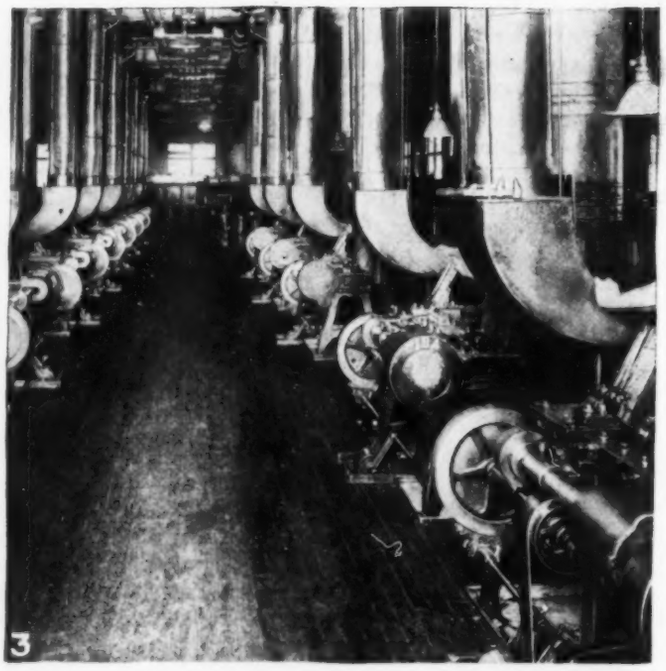
A small current is now led through the ball contacts, by an external controlling resistance and a dry cell, a milliameter in series being used as an indicator for convenience in adjustment. The micrometer spindle is turned until contact is just broken when the net load transmitted through the upper part of the rod *N* is zero. A slight pressure added to the dead load on the rod will close the contact by reducing an air gap. So small is this gap that the final adjustment of the ball contacts through the turning of the barrel *S* can only be done by repeated trial and error, that is if considerable definiteness in the value of the load at the closing of the contact is wanted. It has been found convenient to attach to *S* a light arm *B* that can be tapped lightly to move the upper ball up or down, through a small fraction of a micron. The setting of the contact gap is greatly stabilized by the application of a ring of plastic material, say soft wax, around the barrel of the micrometer at *V*. This damps down any lost motion or shake in the screw and keeps the adjustment stable when the critical position of the balls has been found. The arrangement is so sensitive to the temperature that a change of a degree or so may be used as a fine adjustment to establish the exact load end-point desired in the closing of the ball contact. The micrometer caliper applied to this purpose is merely a convenient and ready combination of a stiff spring with a delicate adjusting screw, built in and adapted to setting the zero of registration of the spring as a dynamometer. The method could be elaborated by the use of two or more of the dynamometer contact springs in series, so as to permit the determination of several points on the load-time or load-displacement curve.

Care and Protection

If the registration of the instrument is to be recorded by the oscillograph, the ammeter used for setting and adjusting should be provided with a shunting switch, to minimize the inductance of the circuit when oscillograms are taken. If the device is to be used over an extended period of time, a drop of neutral oil applied between the balls will prevent atmospheric depreciation of the contact surface. The contact conditions are so delicate, on account of the extreme stiffness of the micrometer frame, that care should be used in the selection of the balls, in lining them up axially, in protecting them from dust and moisture, and against an excessive current flow. The contact can handle 20 to 30 milliamperes without excessive depreciation, but the less required for the registering device, the better. The stiffness of the micrometer frame and the hardness and elasticity of the balls makes the device substantially immune to mechanical shocks in use, at least up to gross loads of several kilograms. Firmness in the seating of the two balls, especially the one resting on the insulating disk, is important, as difficulties of obtaining a reproducible setting of the contact-making load under steady temperature conditions are to be ascribed mainly to irreversible movements or strains at this point.

The balls as commercially produced, afford smooth, hard and resilient surfaces, whereas if a ball and plane contact were used, there might be some difficulty on this score and renewal and readjustment of one of the surfaces would not be so easy or so rarely needed as with the means described.

Abstracted from the Journal of the Optical Society of America.



Malleable Chain

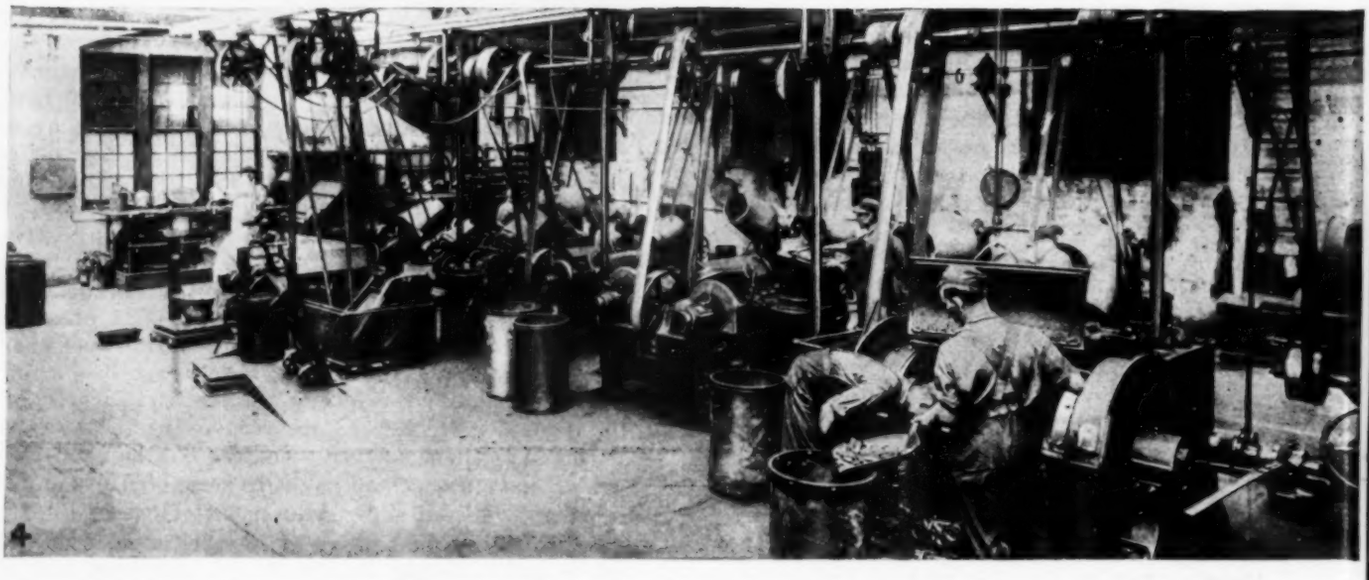
Fig. 1—Straightening Ewart-chain links under drop hammer after annealing

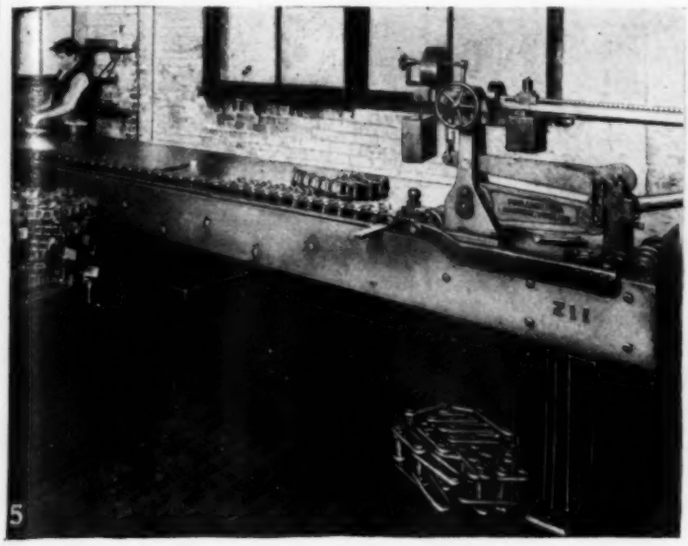
Fig. 2—Presses having semi-automatic feed for straightening plain links

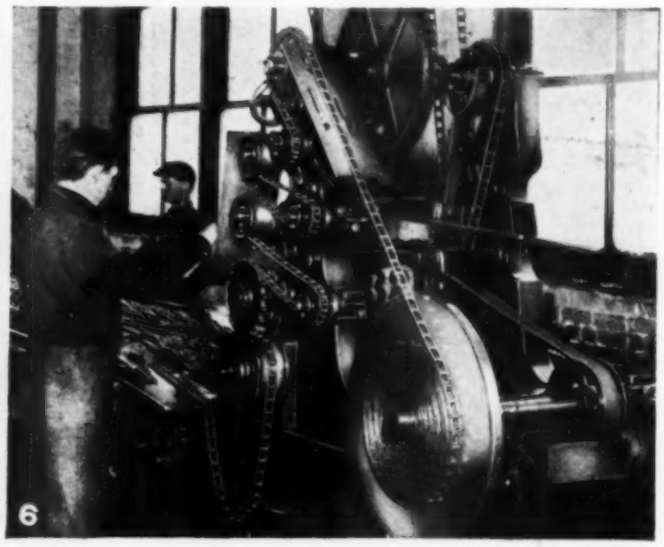
Fig. 3—A section of the automatic chain-assembling machine department

Fig. 4—Centralized "laundry" - where metal parts are cleaned before being distributed to the various assembling departments

Photographs by courtesy of







In the Making

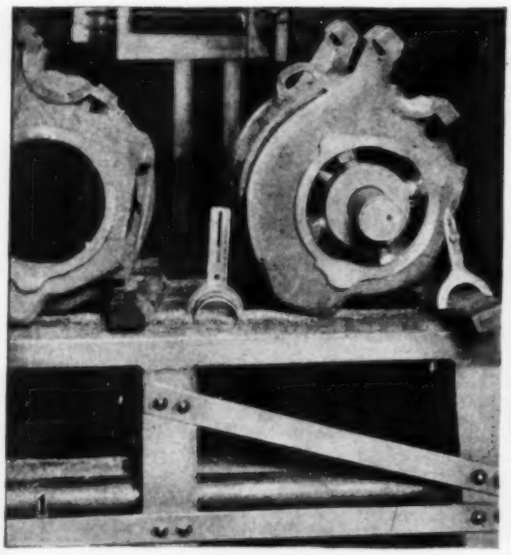
Fig. 5—Testing and inspecting the smaller detachable-link chains

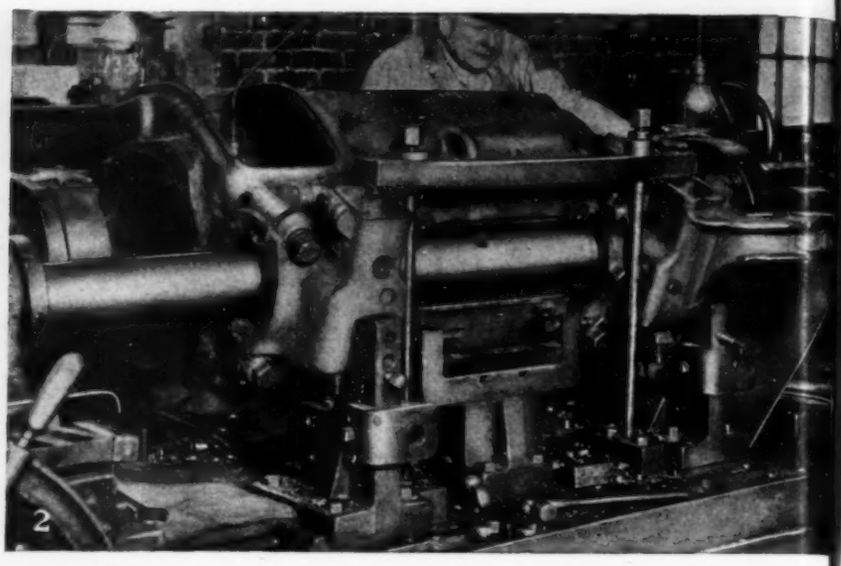
Fig. 6—The "breaker" that carries the chain back and forth over small sprockets and limbers up all the joints. It also wraps the chain for stock or shipment

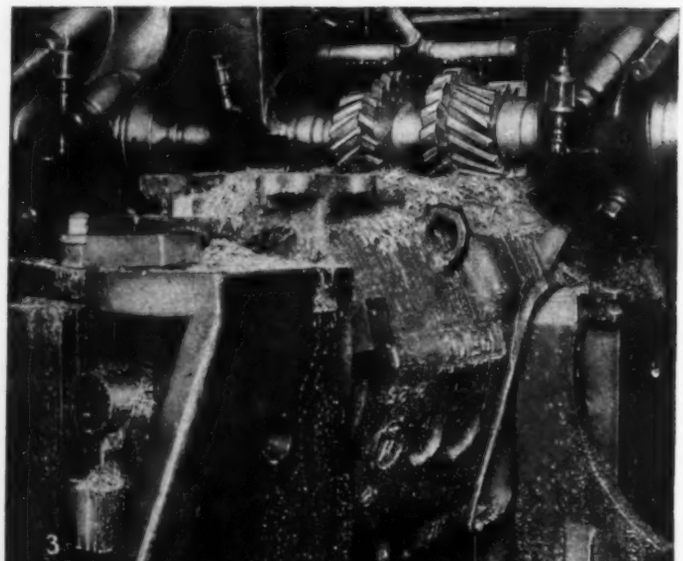
Fig. 7—Testing and inspection table

Fig. 8—Inspection bench and stock of chains ready for shipment

The Link-Belt Co., Chicago, Ill.







Machining and Assembling

Fig. 1—Fitting mandrel for milling axle seat

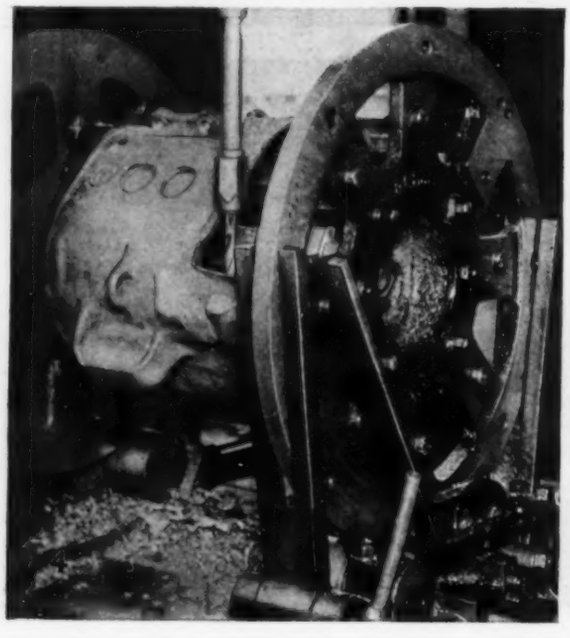
Fig. 2—Boring for armature and axle on 4-spindle Newton machine

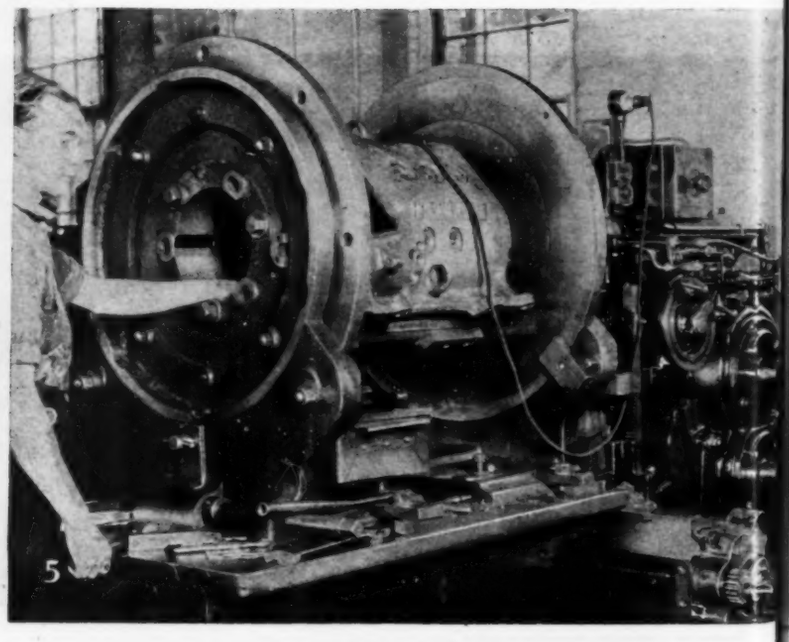
Fig. 3—Milling the axle seat

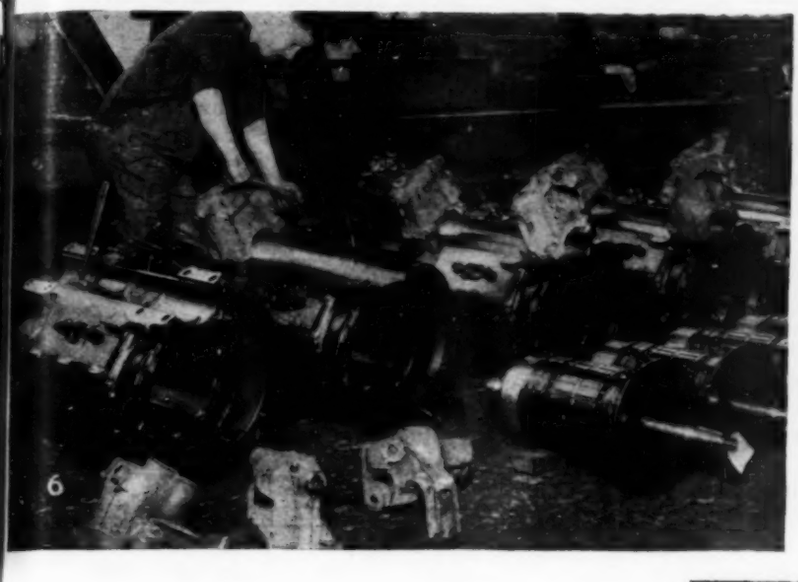
Fig. 4—Drilling for poles and brush holders

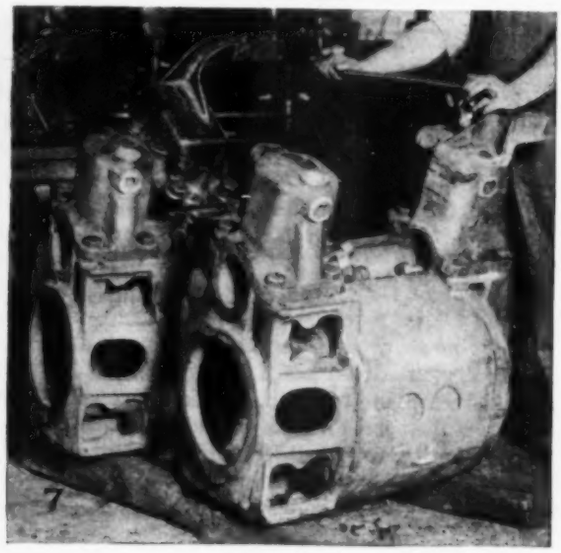
Fig. 5—Machining pole seats on a Morton draw-cut shaper

Photographs by courtesy of th·









Street-Railway Motors

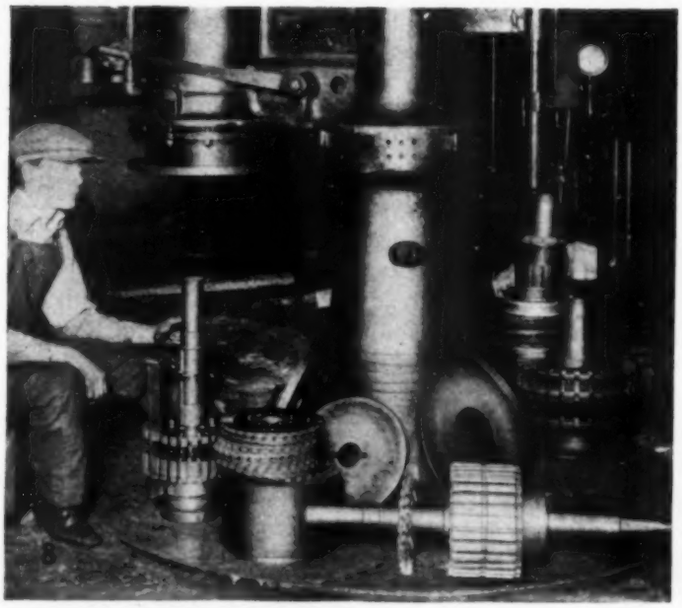


Fig. 6—Assembling axle caps, armature housings, etc.

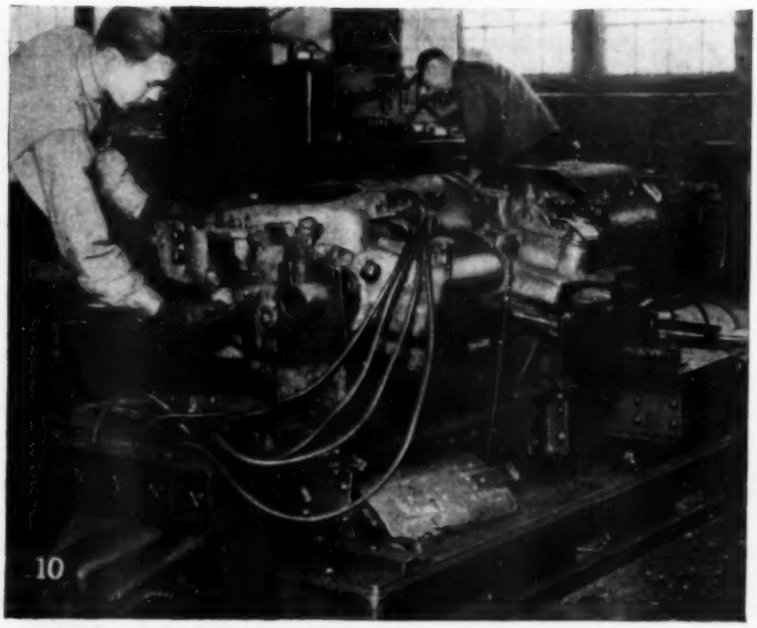
Fig. 7—Bolting axle caps to frame before boring

Fig. 8—Armature assembly by radial air press

Fig. 9—Final assembly of bearings, pinions, etc.

Fig. 10—Final test of a No. 510 motor

Westinghouse Electric & Manufacturing Co.



Book Reviews

Crucible Steel. Over three hundred pages, 4½x7 in. Published by the Crucible Steel Co. of America, New York City.

This book is much more than a catalog, even though it bears no title but that of the Crucible Steel Co. Users of steel are told how to order whatever kind or grade of steel they need, and many are likely to be surprised at the many shapes in which high-speed steel can now be secured. Carbon tool steel also receives considerable attention and suggestions are given as to the heat-treatment of both. Special uses of steel receive careful attention and suggestions are made as to the best kind to use for different purposes.

A section is devoted to alloy steels for special purposes, the uses and properties of Rezistal alloys being described at length. Stainless and heat-resisting alloys are covered in the same section. The best tools for machining these tougher alloys are considered and steels for casehardening and heat-treatment also receive careful attention.

High-grade steel and wire specialties have a section that gives information on such steels as cold-rolled sheets and tool steels for razor blades, surgical and other instruments, saws, drill rods and the like. There is also a small section devoted to useful tables of steel specifications, weights of bars and plates, temperature tables and other useful data.

Four Years of Labor Mobility. By the Industrial Research Department of the University of Pennsylvania. Published as a supplement to Vol. 119 of the Annals of the American Academy of Political and Social Science.

This is a study of labor turnover over a four-year period in a group of selected plants in the city of Philadelphia, from 1921 to 1924 inclusive. The authors are Anne Beazan, Marian Hussey, Joseph Willits and Leda F. White. No claim is made for original methods or conclusions. The aim is to show the necessity for a study of the problem from a community viewpoint, as well as for the individual plant. The study is divided into thirteen sections and includes variations in the number employed, total turnover rates, main divisions of labor turnover and the major reasons therefor, length of service, the effect of grades of skill on turnover, comparisons of men and women employees, influence of nationality and also of education. The method of compilation is also given and some very useful statistics have been brought together.

The Metallurgy of Aluminum and Aluminum Alloys. By Robert J. Anderson. Nine hundred pages, 6x9 in. Two hundred ninety-five illustrations. Published by Henry Carey Baird & Co., Inc., New York City. Price $10.

A comprehensive study of aluminum and its alloys from many angles, beginning with a historical survey and ending with many examples of forming, milling and otherwise machining aluminum in various forms. In between are chapters on aluminum ores, production of aluminum, physico-chemical properties, corrosion, alloys, uses and applications, preparations, melting practice, secondary alloys, casting losses, die casting, rolling, diagrams of thermal equilibrium, micrography and macrography, heat treatment, soldering and welding.

The author is a consulting engineer whose experience includes work in the Bureau of Mines, Carnegie Institute, Bureau of Aircraft Production and as an Instructor in Metallurgy. The book is designed to serve as a textbook, not only for colleges but for all engineers using aluminum or its alloys. As examples of the practical nature of the book, the section on soldering and welding, and that on machining are to be commended to the reader or student. Many examples are given and the author is very liberal in crediting the sources of his information. The book is designed to take the place of the classic on the same subject by the late J. W. Richards, which has not been revised since 1896 and cannot, therefore, longer be considered as an authority.

American Railway Tool Foremen's Association Year Book: Official proceedings of the Railway Tool Foremen's Association. Two hundred eight pages, 5½x8½ in. Published by the Association at 11,402 Calumet Ave., Chicago, Ill. Price $3.

This is the report of the twelfth annual convention held at Hotel Sherman, Chicago, Sept. 3, 4, and 5, 1914, and contains the information brought out at the meeting. Among the subjects discussed were Pneumatic hammers. Heat-treatment of steel. Maintaining, checking and issuing tools in the tool room. Jigs and devices and the application of radial staybolts. These subjects were discussed from various angles. Other topics, such as wrenches, angles of lathe centers for different work and other matters were also brought out. The proceedings show the methods used in different railroad shops and contain much information as to present practice along a number of different lines.

Automobile Trouble Chart. By Victor W. Page. Published by Norman W. Henley Publishing Co., New York City. Size 25x38 in. Price 35c.

This is a chart of a typical, three-bearing, 6-cylinder engine with the essential parts shown in section and named. On each margin are columns in which symptoms of troubles are given, with the probable cause and the remedy. These troubles are divided into three headings, Lost Power and Overheating, Noisy Operation of Power Plant, and Skipping or Irregular Operation. Suggestions are given as to how the chart can be used to advantage.

Science in Modern Industry. This is No. 208 of the the Annals of the American Academy of Political and Social Science, Published by the Society, Philadelphia, Pa. The pamphlet consists of six parts dealing with the partnership of science and industry; scientific methods in purchasing; cost and budgeting; production management and plant engineering; personal research; the educational work of management organizations; and is management the coming profession? The volume is made up of contributions from twenty-two authors in varied lines of industry and gives a sort of cross-section of the present trend along the various phases of modern business mentioned in the sub-headings. Every business manager will do well to familiarize himself with some of the ideas brought out by the various authors.

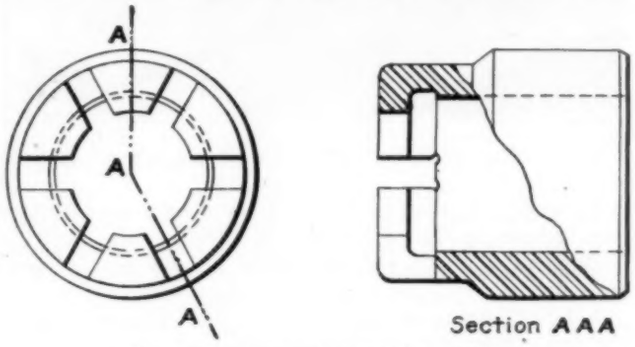
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Inspection Gage for Spline Shafts

BY FRANK WALDO

The usual gage for inspecting spline shafts is of the built-up type, having a ring portion for the outside diameter of the splines and several small blocks for gaging the distances between the splines. The construction requires great care on the part of the toolmaker in order to maintain the limits of accuracy. Even after



Inspection gage for spline shafts

accuracy is obtained, there is a possibility of dropping or knocking the gage in some manner, so as to disturb the alignment of its working parts, making it useless until repaired.

A one-piece gage, such as illustrated, will be found very efficient for inspecting spline shafts. It cannot get out of alignment, is comparatively simple in construction and, when applied to the work, will show at a glance whether the splines are milled uniformly and central or if the diameters of the work are correct and in proper relation to one another.

Polishing the Insides of Eyebolts —Discussion

BY GEO. DOUGLAS

The method of polishing the insides of eyebolts, described by C. B. Mackay, in an article under the title given above, on page 403, Vol. 62, of the *American Machinist*, will undoubtedly do the work, but it wouldn't be practical to use in a shop turning out any great number of such pieces.

For real production work, a "plug" polisher about half as large in diameter as the hole in the eyebolt, and a few inches long, should be used. This plug is mounted on the end of the polishing spindle and runs at a high rate of speed. The eyebolt is simply slipped over the revolving plug and manipulated by the workman until the desired finish is obtained. In most cases, this finish will extend far enough around the inside of the eyebolt for the wheels used to polish the outside to meet it.

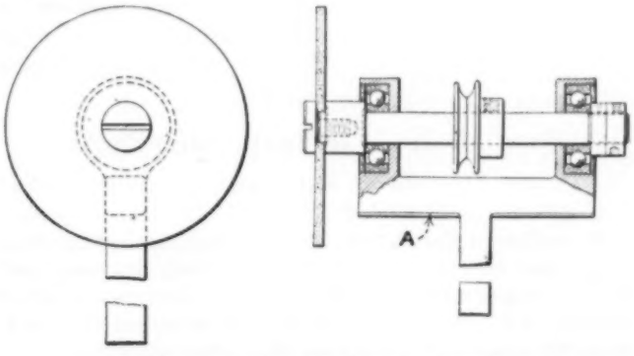
Where this is not possible, a plug wheel with one or more grooves in it of suitable size should be used. Such grooved wheels will easily polish more than halfway around the diameter of the eyebolt, if the grooves are correctly made and the diameter of the wheel is not too large for the hole. Plug wheels of the kind mentioned are coated with abrasive in exactly the same way as are the wheels used for polishing the outside of the eyebolt.

Toolpost Grinder for the Bench Lathe

BY CHARLES J. TUTTLE

For the grinding of small parts in a bench lathe, such as pins, shafts, castings and forgings, the attachment shown will be found suitable for producing accurate work.

The casting *A*, forming the body of the grinder, houses two ball-bearings in which the spindle is mounted. Since the shank is central with the body, the grinder may be used either side up. The abrasive wheel is 3 x $\frac{1}{2}$ x $\frac{3}{8}$ in., though a wheel of wider face can be used.



A grinding attachment for the bench lathe

The construction of the attachment is simple, requiring a minimum amount of machining. By slightly modifying the spindle, a split collet can be used in place of the wheel, making the attachment suitable for small drilling purposes.

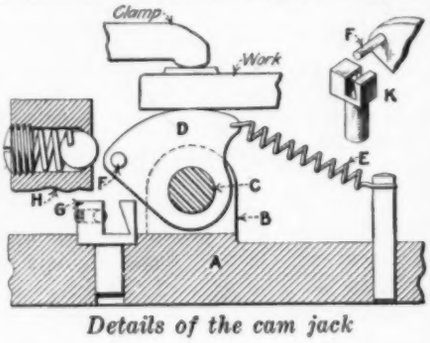
Such a tool is very convenient and many uses will be found for it in the small shop.

IDEAS FROM PRACTICAL MEN

Cam Jack for Light Work

BY GENE PHELPS

The successful operation of a jack generally depends on the one who uses it and, like any tool or mechanism, it can be misused. Not long ago I saw a job in which an overhanging part of the work was supported by a jack of the plunger type. Sometimes the operator applied too much pressure to the jack, springing the work just enough to offset the portion being milled. The problem was to devise another means of supporting the work that would be practically fool-proof, and was solved by the construction of the cam-jack shown in the illustration. The results obtained were satisfactory, inasmuch as the work was not sprung out of shape, as it had been before the cam jack was used.



Details of the cam jack

The base of the fixture *A* is provided with a boss *B*, slotted through the center and drilled for the pin *C*, which carries the cam plate *D*. The spring *E*, attached as shown, pulls the cam under the work until it bears against the underside. The clamp, located directly over the center-line of the pin *C*, holds the work securely. When the clamping pressure is released, the cam is pushed back by the finger until the pin *E* engages the locking device *G*. An enlarged view of the lock is shown at *H*. While a glance at the drawing might lead one to believe that the locking device is in line with the cam, this is not true, as will be seen in the view shown at *K*.

The use of a jack of this type should not be attempted for work having large variations in the height of the locating surface, as there would be a possibility of the cam having the necessary range working loose under pressure of the cut. An advantage worth mentioning is the ease by which the fixture can be cleaned, since there are no hidden parts subjected to clogging by chips.

Two Methods of Inspecting Taps

BY B. S. HAVENS
General Electric Company

In order to determine the accuracy of taps within very close limits, two checking methods are employed in the gage room of the General Electric plant at Schenectady. One of these is for checking the lead, and the other for verifying the pitch diameter.

In checking the lead of a tap, it is a very simple matter to determine whether there is an appreciable variation over the allowance permitted, depending upon the accuracy of the work for which the tap is to be used and the size of the tap being inspected. In order to determine the extent of the inaccuracy, the tap is first placed in bench centers. As an accessory, a small table, specially constructed, is adjusted alongside of the centers. The table is provided with a flange on one edge to hold in position the device used for measurement of the lead.

An indicator, having a needle that fits between the threads of the tap, Fig. 1, is placed on the table, which

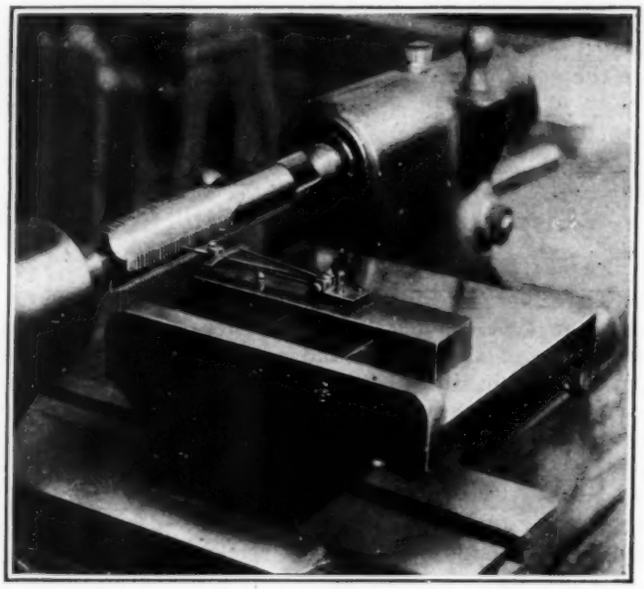


Fig. 1—Indicator for determining variation in lead

is so adjusted as to bring the needle between the first two threads at the center line of the tap. Its position is determined by a pointer which should rest at zero on a dial.

A 1-in. Johannson gage-block is then placed between the indicator and the flanged edge of the adjustable table, and the needle again inserted between the threads of the tap. Any variation in lead will then be regis-

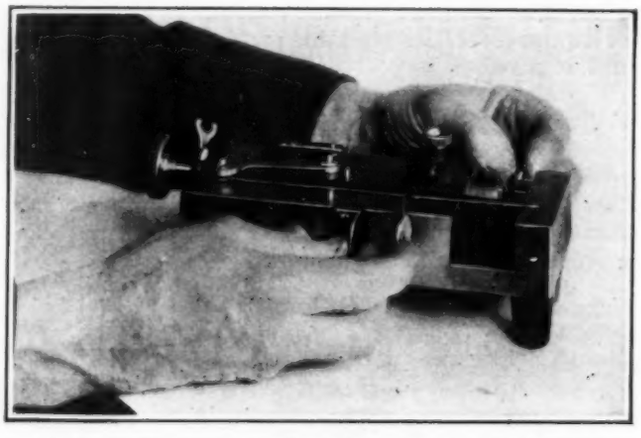


Fig. 2—Comparator for checking pitch diameter

tered on a dial by the pointer mentioned. The dial in question is calibrated in ten-thousandths of an inch. The allowable variation in lead for taps in the General Electric plant is 0.0008 in. per inch.

The pitch diameter of taps having even numbers of flutes is determined by the three-wire method. For checking the pitch diameter of taps having odd numbers of flutes, a specially designed comparator, as shown in Fig. 2, was made.

IDEAS FROM PRACTICAL MEN

Two blocks or jaws, known as anvils, are positioned at one corner of the comparator and are kept in sets of different sizes to check the pitch diameters of taps of various sizes. One anvil has a V-notch for straddling one thread of the tap, and the other a projecting angle, or the reverse of the V-notch, for fitting between the tap threads.

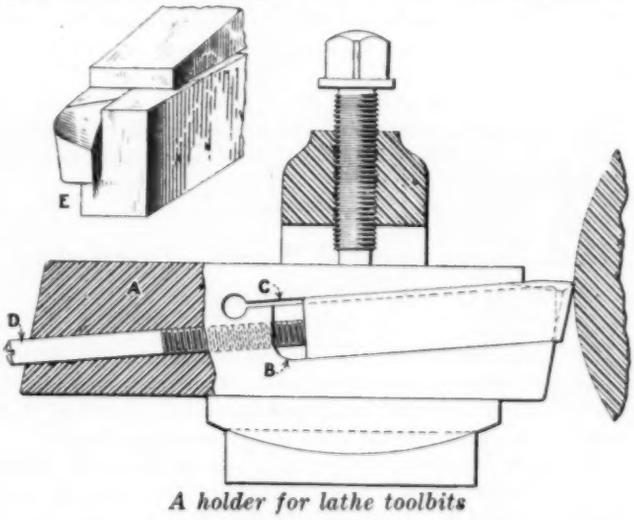
The anvils are first set in the comparator and a standard thread gage, corresponding in pitch diameter to the tap to be measured, is placed between them. A calibrated scale near the anvils has its center-reading at zero. After the thread gage has been set in position, the pointer is adjusted to zero reading. Pressure of a transverse lever releases the anvils from the thread gage, which is then removed and the tap inserted. If the pointer shows a minus reading, the tap is too small for use. If, however, a plus reading is shown, within the specified allowance (varying according to the size of the tap), the tap is satisfactory for use.

A Holder for Lathe Toolbits

BY C. W. FRANK

The tool holder illustrated can be easily constructed and will be found useful for the average work. The features of the holder are that the toolbit is clamped by a flat surface in place of the usual setscrew, and the cutting end of the tool is well backed-up. This construction reduces the breakage of the toolbit, increasing its life through the additional rigidity rendered when under pressure of the cut.

The holder *A*, made of tool steel, is slotted at *B* to receive the toolbit and is saw cut at *C* so that the



A holder for lathe toolbits

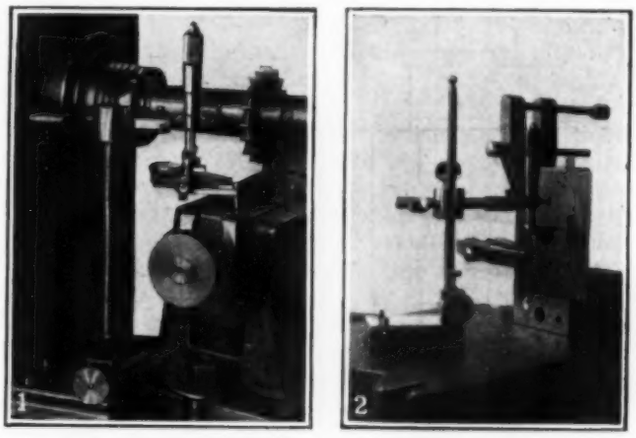
upper portion acts as a clamp when mounted in the toolpost. The screw *D* is for adjusting the bit and tends to act as a backstop. The view at *E* shows the end construction and the method of backing up the toolbit close to the cutting edge. The holder is given a spring temper to insure longer life and so as to retain a proper clamping action. While the tool shown is for right-hand cuts, a reverse of the design will provide for a left-hand tool.

A Useful Combination Gage

BY PERCY W. BURDICK

The illustration shows a very handy combination of a B. & S. No. 250 inside caliper and a "Last Word" test indicator. By the use of these tools, indicator readings can be taken over a vertical range of one inch, and by resetting with gage blocks, readings can be taken up to the limits of the gages available.

This combination can also be held in a chuck in the



Figs. 1 and 2—Uses of the combination gage

milling-machine spindle and used for accurately indicating the movement of the knee and table in jig boring and other close work, where the actuating screws are not accurate enough.

Where no vernier height gage is available, a scriber and holder can be attached to the micrometer spindle and the gage used to transfer heights from gage blocks to the upper surface of a flat scriber.

Device for Filling Grease Cups

BY C. G. WILLIAMS

The grease gun, that almost indispensable auxiliary to the automobile, has at last been adapted, though in a somewhat different form, to the use of the railroads.

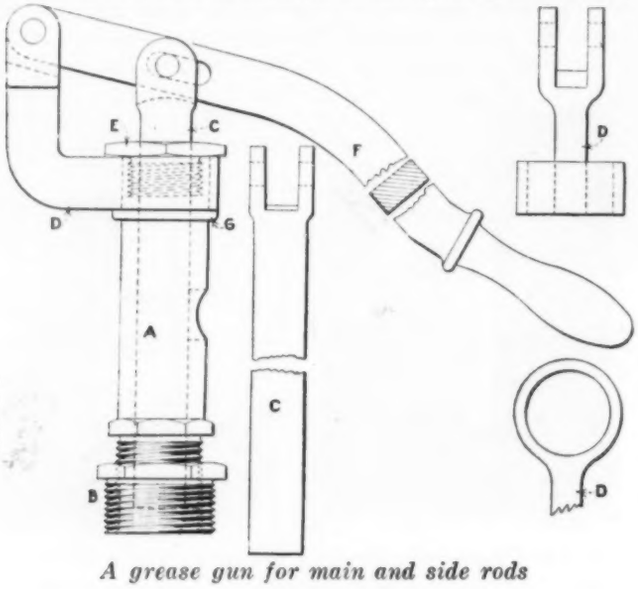
One of the bug-a-boos of the railroad roundhouse has been getting the grease cups on main and side rods filled prior to the time for the locomotive to be called out on the road. As this has always been considered a laborer's job, the lowest paid type of labor has been assigned to it, generally old men or boys, and in some of the larger roundhouses two and even three men have been employed on a shift to take care of this important phase of roundhouse work.

Filling grease cups has always been a monotonous as well as a dirty job, and the old way of cutting off a thin slice of grease, forcing it down by screwing in the grease plug with some type of wrench, removing the plug and inserting another thin slice of grease, only to repeat until sufficient grease has been applied to that pin, has not been conducive to a conservation of time. With the advent of the grease gun, a man could easily grease a set of side and main rods in one tenth the time it formerly took. Not only does it take less time,

IDEAS FROM PRACTICAL MEN

but there is not the wear and tear on the threads of the grease cups nor of the plug, and the danger of cross threading or stripping the thread, with the resulting ruination of the entire thread, is eliminated.

Instead of the grease being issued from the oil house in sticks 1¾-in. diameter, it is now issued in ⅞-in. cords. One end of a cord is inserted in the opening in the body



A grease gun for main and side rods

of the gun illustrated as the handle is raised to its highest point, and a slight downward motion of the handle cuts off a piece and forces it into the barrel of the gun. A few up and down motions of the handle suffice to fill the barrel and by throwing one's weight on the handle, the one motion forces the contents from the gun into the grease cup.

The gun consists of the main barrel *A*, the lower end of which is threaded to fit the smallest grease cup on any of the locomotives on the road, the larger sizes being cared for by the use of bushings, one of which is shown at *B* on the gun; the plunger *C;* the yoke *D;* the cap *E*; and the lever *F*. The yoke *D* is made a sliding fit on the barrel above the collar *G* and held in place by the cap *E*. This allows the barrel of the gun to be revolved as it is screwed into the grease cup, without revolving the entire lever.

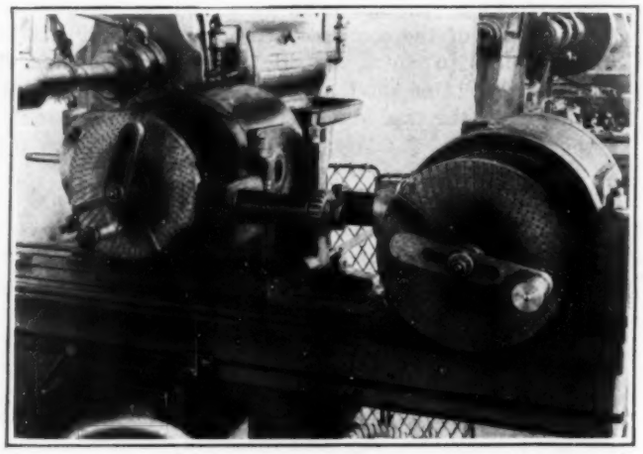
Unique Method of Indexing Unusual Numbers

BY R. VON ROTZ

A simple and flexible method of indexing high and unusual numbers is shown in the illustration.

In the course of construction of a piece of experimental apparatus, it was necessary to graduate a segment for 450 divisions at 7½-in. diameter. Obviously such a number cannot be accurately indexed with the dividing head and index plates, as usually furnished with universal milling machines.

The problem was solved by means of the set-up shown. The equipment consisted of two standard dividing heads mounted on the table of a No. 3 Cincinnati



Set-up for indexing unusual numbers

plain milling machine. The heads were geared together by means of a pair of duplicate spur gears. The work was mounted on a stub arbor held in the spindle of the left-hand head. A milling cutter was used to cut the graduations on the circumference of the work.

The reduction ratio between the worm and worm wheel in each head is 40 to 1, hence the total reduction will be:

$$3\frac{30}{54} \times \frac{1}{40} \times \frac{1}{40} = \frac{1}{450}$$

The indexing was done by means of the crank on the right-hand head which was set at the 54-hole circle. The crank was turned three complete revolutions and 30 holes in addition, for each division.

The set-up shown provides a practically unlimited range of index numbers. With duplicate gears connecting the heads, the maximum number of divisions would be,

$$66 \times 40 \times 40 = 105{,}600$$

By varying the ratio of the connecting gears between the head, a still wider range of divisions will be obtainable.

Reclaiming Spoiled Work—Discussion

BY J. T. TOWLSON
London, England

On page 358, Vol. 62, of the *American Machinist* Charles Kugler, in an article under the title given above, cites a case of spoiled work reclaimed by a method that reminds me of a similar case in my own experience.

Through somebody's error a couple of gross of round rods of bright-drawn mild steel had been cut off ⅛-in. short of the 3-ft. length required. The boss was much incensed when he discovered the mistake, but had no suggestions to offer with regard to how it might be corrected.

Lo and behold! When the boss arrived at the shop on the following morning, all those rods were 3-ft. long and apparently no different in other respects from what they had been the night before. We had just run them through a pair of forming rolls of the proper size and shape, stretching them out to the requisite length without materially altering their diameter.

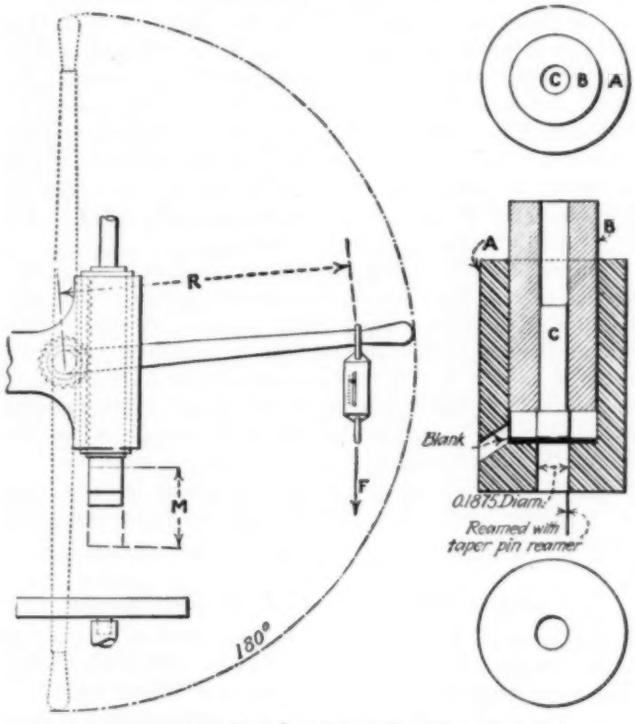
IDEAS FROM PRACTICAL MEN

Test Die for Finding the Shearing Strength of Metals

By Henry Simon

There are times when a knowledge of the exact shearing strength of some metal becomes important, if not indispensable. The strength of standard types of rolled sheet material is, of course, known and any likely excess strength can in most cases be allowed for. In many other cases, however, the shearing properties are not known, or are apt to vary more or less and, if much in excess of the assumed strength, are likely to cause trouble. It must also be remembered that while the tensile strength of some material may be known, it is by no means necessarily identical with the shear, which may amount to a totally different and much higher figure.

A case of this kind occurred when it was proposed to produce a series of holes in certain hollow screw-machine products by a new process depending upon a fixed equation between time, leverage, and force, with the latter two items restricted to a low maximum. The shearing strength of free-cutting screw-stock was unknown, but was taken at 55,000 to 60,000 lb. on the assumption that such stock would be relatively soft. It was decided before undertaking the job, however, to obtain exact knowledge. As a result, the test-die here illustrated was designed, and by its use the shear of



Apparatus for determining shearing strength

the material in question was shown to be 75,000 lb. The resulting revision of the first plan, with the time element increased by a corresponding amount, resulted in the immediate success of the job from the very beginning.

As will be seen, the device is very simple, and can be easily made in any shop at slight expense. It consists of a tool-steel shell *A* having a thick bottom, in the center of which is formed the die-hole, which in this case was of 1.89 in. diameter, and of a straight tool-steel cylinder or punch-holder *B*, making an easy sliding fit in the shell. The latter part carries a drill-rod punch *C* made to fit the die-hole with the usual clearance. The hole in the die-shell is formed with a clearance of about half a degree by reaming it with a taper-pin reamer from the bottom end.

The test-blanks may be round or square pieces of the material to be tested, and do not necessarily have to be of exactly the same thickness always, although the micrometer measurement of each must, of course, be carefully noted. In view of this, and also of the fact that the clearance between the punch and die must be held within certain limits to get accurate results, it is best to decide upon two or three, or if necessary more, standard thicknesses for test-pieces and to adhere to these measurements, using a punch 0.0005 in. smaller for each increase of 0.010 in. in the thickness of the test-piece.

A convenient and entirely satisfactory way to make the test is by the use of an ordinary drill press and a spring scale. The die, with the blank and punch in place, is set up on the drill table, the chuck run down on it, and the height of the table adjusted to bring the feed-lever into position very slightly above the horizontal. A spring scale is hooked over the lever in the notch just back of the handle, a straight downward pull applied to the scale, and the point noted at which the break occurs.

To obtain the leverage ratio of the drill press, use the equation: $Lr = \frac{R\pi}{M}$, in which R is the length of the lever from pivot center to point of application of scale-hook, and M = movement of spindle when lever is swung over an arc of 180 degrees.

The searing strength of the metal is:

$$Sh = \frac{FLr}{DT}$$

or the pull on the scale at the time of the break, times the leverage ratio of the drill press, divided by the circumference of the test punch, times the thickness of the test piece.

The clearance between the diameter of the punch and the hole in the die is obtained by the usual clearance formula: $\frac{\text{Thickness}}{20}$, and this clearance should be maintained within the limits before mentioned of 0.0005 inch.

After each test, the punch holder is pulled out and the punch knocked out, when the test piece will drop off, thus a few seconds only being required to get the die ready for the next test.

The diameters of the punch and hole depend upon conditions, but a punch of from 0.125 to 0.1875 in. will ordinarily be found right, and will make it possible to test 0.031-in. metal with a pull of somewhere between 25 and 50 lb., depending upon the kind of material and the leverage ratio of the drill press used. In a general way, a thickness of metal as near as possible like the thickness of the material to be used is to be recommended for the test blanks.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Pressure Required to Form Pressed Steel

Q. What pressure should we figure as necessary to form a given piece of pressed steel work?

A. There are many factors which will affect the pressure required such as the possibility of bottoming on varying thicknesses or the necessity of bottoming in order to iron out the work, the amount of thinning of the steel on the sides of the draw, the amount of taper at the top of the dies where the part is started in and other similar considerations.

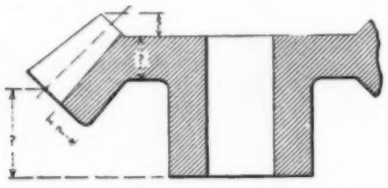
A general idea may be had by assuming a capacity sufficient to break through the piece at the outline of the form using the shearing value of the steel against the product of length of outline and thickness of section, remembering that this figure will be materially increased if there is any binding action on the work between the punch and dies.

The fact should also be borne in mind when assigning a press to the job that its rated capacity must be proportionally discounted if the point where the form breaks over comes above a 20 per cent off-center position of the press crank.

Dimensions of Bevel Gears

Q. Will you tell us where we can get practical formulas for the calculation of the dimensions on bevel gears, as indicated on the accompanying sketch?

A. The dimensions of the gear as shown on the sketch relate to design only and have no bearing on



the actual function of the teeth or tooth parts. They may be anything the designer chooses to make them, providing strength is not sacrificed.

Drilling Hard Cast Iron

Q. I am having trouble with a 1-in. high-speed drill on a hard grade of cast iron and would like to know the best angle for grinding the point, the cause of excess burning at the extreme cutting lips and the cause of the drill laboring while cutting.

A. The usual grind angle for a drill is 59 deg., but on work similar to yours an angle of approximately 64 deg. will be found more suitable. The drill will hold up better at the point and will get under the work quicker. It will also break through hard stock somewhat better than the 59 deg. point, eliminating the tearing of the work and chipping of the drill corners.

Your speed is probably high as this is the usual cause of burning at the drill margin. Try reducing the speed about 15 per cent and increase the feed accordingly and you should get longer life and avoid burning action.

The laboring of a drill is caused by a dull drill or an improperly ground point. Thin the web of the drill to $\frac{3}{32}$ in. by grinding the flute with the edge of a wheel, making sure not to touch the cutting lip, and you will find the cutting action to be free from friction.

Testing Water Heater Coils

Q. We have a number of copper water-heater coils to test to 200-lb. water pressure and want to know of a way of obtaining the necessary pressure at a minimum of investment in equipment. The only pressure we have at present is approximately 50 lb. from our water main.

A. By purchasing or building a small accumulator to which you can connect a manifold to take a number of the coils and by arranging valves to prefill the units you can make up a satisfactory testing assembly for utilizing the pressure on your water main.

The accumulator consists essentially of two cylinders, one larger than the other, and a double piston.

The pressure of 50 lb. from the main is admitted through a three-way valve to the large cylinder. The large piston, through its rigid connection pushes the small one against the water in the testing assembly. Neglecting friction the ratio of areas of the two pistons should be four to one. In practice, however, it would be better to make the ratio six to one to take care of friction, and to provide an excess capacity should the pressure fall somewhat in the main.

The other side of the three-way valve should be connected to the high-pressure cylinder so the valve can be turned to return the pistons to their starting point and at the same time fill the coils to be tested. A check valve is needed in this line to back up the high pressure and a relief is needed between the large piston and the cylinder head to allow the water to escape when the piston is being returned to the starting position.

A 14- or 15-in. stroke should be ample to take care of possible leaks in a number of coils being tested simultaneously.

Cutting the Tool Slot in Toolposts

Q. What is the best way to cut the slots in a lot of 50 lathe toolposts? The material is $1\frac{3}{8}$-in. cold-drawn steel. The slots measure $1\frac{1}{16} \times \frac{5}{8}$ in. and have round ends.

A. The best way to do the work will depend to a large extent on the equipment available in your shop. Without knowing the details, however, we should advise drilling one of the end holes and then milling the balance with a finger mill of the helical type.

If you have no milling machine you can arrange to clamp the toolposts on the toolblock of your lathe and, with the finger mill driven between the lathe centers, use the cross-slide to feed the work.

Technical Abstracts

Grinding Practice

H. A. Dean presented a paper on this subject before the British Institute of Production Engineers and discussed the ever widening scope for grinding processes. In the large field of mechanical industry he states it is being daily demonstrated that greater speed, closer accuracy and material reductions in operating costs invariably follow the introduction of up-to-date grinding methods into every possible phase of manufacturing. He suggests that in grinding aluminum, the trouble experienced with scratches on the surface of the work can be avoided by filtering out all aluminum chips or swarf from the cooling lubricant. He recommends as a lubricant a mixture of lard oil and paraffin in the proportions of one to ten.

Discussing the question of chatter he states that sometimes the driving dog sets up vibration, owing to the fact that there is torsion in the dog when a heavy cut it taken. Sometimes vibration of the wheel spindle causes spiral chatter marks. Driving belts of uneven thickness are another source.

No fixed rule can be given for determining the proper combination of eccentric and table reverse in cylinder grinding. Some operators prefer the slow speed for eccentric but a more common method is to use the fastest speed of the eccentric and the slow speed of the table. Cylinder grinding should be done dry. The balance of the article deals largely with well-known fundamental methods used in general practice. —*The Automobile Engineer* (England), March, p. 73.

Some German Automatic Machine Tools

The article is the continuation and end of one that we referred to in a recent issue. The author is Ph. Kelle, Berlin. He first describes briefly machines which are copies of American articles (Potter & Johnston, Prentice) and then passes to a German multi-spindle screw machine manufactured by Alfred de Fries in Cassel. The machine produces four screws at once and provides them with nuts. The work pieces are fed onto a carrier by hand.

An improvement in nut manufacture is a nut facing machine which faces the nut one side only at a time. Facing from two sides simultaneously has previously been used. If the press fins are of unequal height on the two sides, this method causes the one with lower fin to be faced off too much.

The firm of Jos. Koepper & Soehne builds an automatic milling machine for the production of small gears for instruments, etc. The teeth are milled in radially. This leaves the bottom of the tooth space hollow, but for this class of gears this little blemish is of no importance compared with the increased production. There are descriptions of an automatic machine for drilling holes in bicycle hubs; of a universal tool grinding machine and of a grinder for twist drills.

In great detail are described two nut pressing machines made by Malmedie & Co., in Düsseldorf, for nuts up to $\frac{3}{4}$ in. size. The improvement in these machines consists in pre-pressing the work bar to the approximate form of a string of nuts. This pre-pressed bar is carried to the finishing machine. In this way there is a great reduction in material loss. Finally there is shown a special piston lathe.

The writer makes the criticism that there is now in Germany a tendency to let one automatic do too many different things. This impairs its simplicity and dependability. Even if the German market is not as large as the American, it is essential to maintain the automatic machine as a single-purpose machine.—*Zeitschrift des Vereines deutscher Ingenieure*, February 28, p. 289.

Finding Minimum Cost Quantity in Manufacturing

Ralph C. Davis, assistant professor of Industrial Organization and Management, Ohio State University, discusses the important point that often arises in manufacturing when the question is, "how many of a particular item should be made in order to keep cost at a minimum?"

In the average plant no effort is made to determine factors that affect the cost of carrying inventories. It is usually realized that the relation of the cost of setting up the job to the size of the lot affects the unit cost and that the unit cost may be affected adversely as a result of excessive interest charges if the lot is too large. Whether the lot to be manufactured is or is not too large depends on the rate at which the product will be sold and the rate at which it will be manufactured, and Mr. Davis develops in this article a rational method of determining the proper quantity to manufacture and to carry in stock, taking into consideration the following factors of importance:

A—Total set up and preparation cost of processing, including the cost of adjusting and dismantling the equipment.

B—Total cost of the quantity to be manufactured.

C—The direct labor cost per piece along with the material, and overhead cost.

D—The current rate of interest on investment.

E—The rate at which the quantity will be manufactured in pieces per year.

F—The unit cost of storing the quantity, exclusive of the interest charges.

G—The rate at which the stock will be consumed, figured in pieces per year.

H—The time required to manufacture the quantity.

From these factors is deduced a formula and a specific instance is given, taking the annual rate of a particular unit as 10,000, the capacity of manufacture as 125,000 pieces per year, the standard cost for the part being $10 per piece with a cost of setting up and preparing of $605. From this it follows by using the formula that 6,621 pieces is the theoretical number that can best be manufactured at a minimum cost. —*Management and Administration*, April, p. 353.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

A Gordian Knot to Cut

AS WAS to be expected, one of the first results of transferring the Patent Office to the Department of Commerce is an effort to cut the Gordian knot of needlessly complicated and archaic procedure. A committee of office managers is making some progress in simplifying office methods and another committee of patent attorneys is investigating the legal side. As was to be expected, the latter committee sees little opportunity for shortening the legal action.

Here is the present situation: The Patent Office is seven months behind, which means that seven months elapse from the time an application is received until the machinery starts working. Then the application may pass through six stages before the end is reached: patent examiner, appeal to board of examiners, appeal to commissioner of patents, appeal to district court, appeal to appellate division, appeal to supreme court. Six jumps to justice, as one interested observer puts it, and the claimant's cash may give out long before he reaches the final jump.

The commissioner of patents has little time for his administrative duties as eighty-five per cent of it is used up listening to appeals. The same thing applies to his deputy.

Industry is the principal sufferer and consequently should take steps to improve matters. Drastic steps will be necessary as the inertia of bureaucracy and tradition must be overcome and the opposition of hungry legal advisers to boot.

The New Home of the U. S. Chamber of Commerce

THE dedication of the new home of the Chamber of Commerce of the United States in Washington marks the 13th year of successful growth of that organization. During all these years its officers have striven to reach the goal announced at its formation, that of creating an organization that would crystallize the thinking of American business men. In this way they can present the views of business to the public at large and to the officers of the governing and legislative bodies.

While business men make up the organization, there being 12,000 individual and associate members, 1,300 Chambers of Commerce and Trade Associations, they are also part of the general public and as such are affected by public policies. They are, furthermore, employers of labor and they must know the problems that affect their employees. For the successful business man of today realizes that personnel presents the greatest problem in management and one that brings him in close contact with the problems of the general public. As Chief Justice Taft said at the impressive ceremony of dedication: "While your membership embraces especially the business men, they become familiar with every factor affecting the welfare, or illfare, of the country. You are not a faction. Taken together you have no selfish, narrow, or contracted aim that binds you to the general good. You have in you, as much as any set of men, the spirit of good will to all elements of our society."

The great influence of the Chamber is due primarily to its effectiveness in stimulating business men to think of questions of an economic and business character as they affect the country as a whole.

Why Research Lags

RESEARCH work at the Bureau of Standards is seriously handicapped by the attitude of the Government toward its scientific men. The salaries are so inadequate that even the men most devoted to their work and least interested in the financial return they get from it drop out one by one to accept far larger salaries from industrial organizations.

What is the result? A turnover of personnel that would ruin a commercial enterprise and seriously handicaps research because each new man that attacks a given problem must waste much time familiarizing himself with what has been done by his predecessors.

Demands for answers to new problems continue to pour in on the already overworked investigators and sometimes the demands are so insistent that work on projects well under way must be dropped. The result is naturally disastrous. The laboratories fill up with the apparatus employed in partly finished experiments and the men engaged on them are distracted by trying to keep the facts connected with several different researches in mind at the same time.

And, in addition, official red tape weaves its way back and forth through every action and wraps itself around the whole mass, binding, restricting, suffocating. It was provided to prevent unworthy government servants from misappropriating government money. Perhaps it is successful but at the same time it serves as a most perfect extinguisher of ambition, initiative and energy, and thus wastes a hundred times more than it can ever save. Congress can cut the tape if it will but it is undoubtedly more interested in repairing fences than in increasing bureaucratic efficiency.

Shop Equipment News

Cincinnati Railroad Shaper

The 32-in. shaper shown in the illustration has been added to the line of machines manufactured by The Cincinnati Shaper Co., Cincinnati, Ohio. It is intended for railroad work and arranged for the machining of locomotive driving boxes, shoes, wedges, driving-box crown brasses and rod brasses. The shaper embodies all the features of the Climax shaper, manufactured by this company, and previously described on page 893, Vol. 59 of the *American Machinist*.

The machine is equipped with a special table, an extended circular feeding head, a special shoe and wedge chuck, a standard machine vise and a 1,000-lb. boom crane. An indexing fixture for planing driving-rod brasses and a power-driven rotating fixture for crown brasses can be supplied if desired.

The special table is provided with a removable top 9½-in. deep, giving a wide range between the ram and the working surface of the table. The removable top is used when machining the crown-brass fit in driving boxes, shoes and wedges, or when doing the usual run of shaper work, either with or without the standard vise. It is removed when machining the shoe and wedge-fits in the driving boxes, providing sufficient height between the table and the ram to permit the large driving boxes to be placed directly on the table.

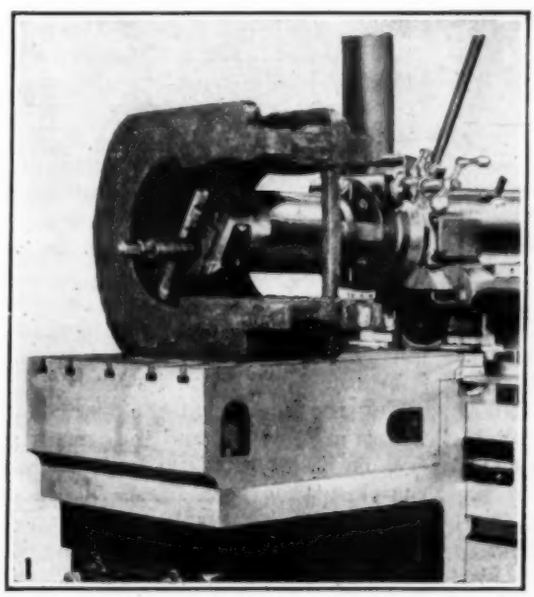
The working surface for the upper table is 32 in. long and 24 in. wide, and that of the lower table is 24¾ in. long by 24 in. wide. Both tables are provided with suitable T-slots for clamping purposes. The upper table has holes conveniently located into which stop pins may be inserted.

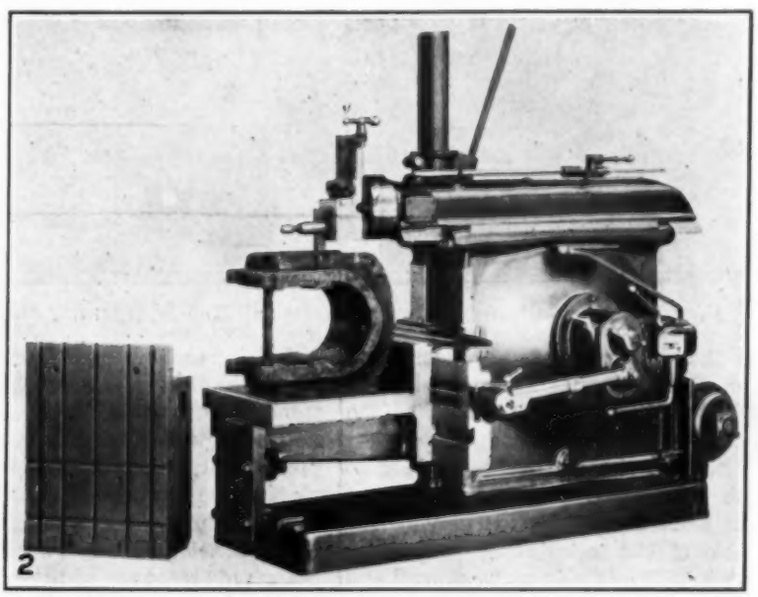
The circular feeding head is used for machining the crown-brass fit in driving boxes ranging from a minimum of 8 in. to a maximum of 18 in. in diameter. The extended body, rigid in construction, is fastened to the end of the ram with four bolts. It may be rotated either by hand or automatically in the same manner as the downward feed of the standard shaper head. This head is furnished in addition to the standard head and uses the same circular T-slot on the end of the ram for bolting.

The special shoe and wedge chuck is arranged to handle both small and large units, and is made in two parts that can be adjusted on the table to suit short or long work, permitting the setting of the surface gage directly on the shaper table when lining up the layout marks. The work rests on four adjusting screws that can be easily adjusted to line up with the layout, and it is held down by eight screws coming in at an angle from the sides. The front half of the chuck is provided with an end-stop bar permitting heavy cuts.

The boom crane fastened to the frame of the machine is rigid in construction with ample capacity for carrying loads up to 1,000 pounds. The vise furnished is of the double-screw type and is of compact design having its working surface 5 in. above the shaper table. The 3 x 15-in. jaws open a distance of 15 in. Four bolts are used for swiveling and securing the vise to the table. One wrench is required for the vise, table support screws and all of the other clamping nuts that are used for making adjustments.

In addition to the features outlined, the shaper provides the advantages of the standard machines, including full-automatic oiling that





Figs. 1 and 2—Cincinnati Railroad Shaper

SHOP EQUIPMENT NEWS

gives adequate lubrication to all regularly moving parts of the machine, the ram ways and the rocker-arm mechanism. Eight speeds are obtained through the internal transmission that is entirely built within the column of the machine and runs at all times in a bath of oil. The feeds are operated by cams insuring smooth action. The feeding mechanism is fully inclosed and also operates in oil. Stroke lengths are rapidly set without the necessity of starting the machine to determine their size. The machine is guarded for the operator's protection against danger from moving parts and belts and for the protection of sliding surfaces against chips. Either a belt or a motor drive can be furnished.

Barber-Colman Automatic Hob-Sharpening Machine

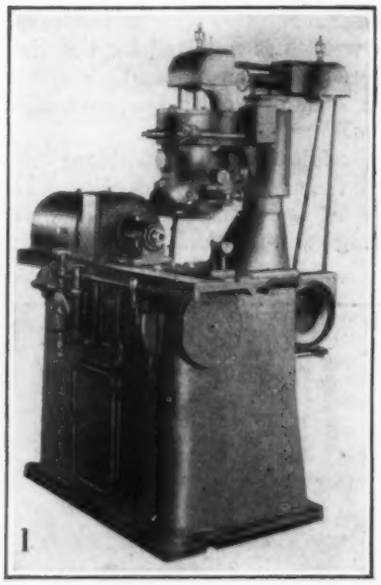
Several changes have been incorporated in the design of the automatic hob-sharpening machine manufactured by the Barber-Colman Co., Rockford, Ill., and originally described on page 41, Vol. 56 of the *American Machinist*.

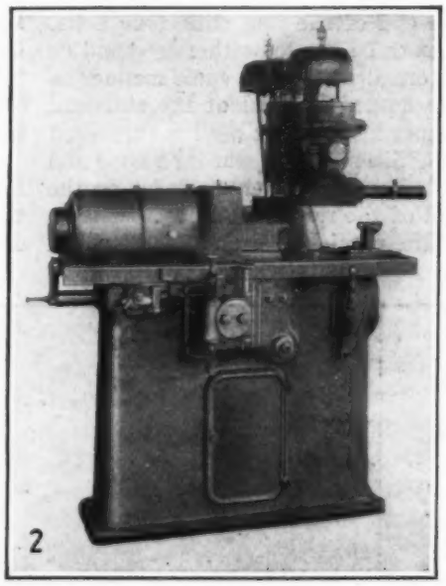
One of the important changes is the redesigning of the bed and table ways, now arranged so that the indexing and spiral-generating mechanisms are completely housed. By this improvement these units are guarded against dirt and grit, caused by the redressing of the wheel or by the actual sharpening, and will also add to the correct alignment of the machine.

Ball bearings have been added to the table-drive mechanism so that the wormshaft used for driving the table of the machine has an easier motion. The feed-handle control and the handle for setting the spiral-lead mechanism have been positioned to a more convenient location, to ease their manipulation by the operator. The lost motion between the hob and the guide bar that controls the work spindle is provided with a spring take-up adjustment. This device is operated by a threaded rod located on the extreme left of the machine.

A single-unit drive and countershaft bracket supersedes the three separate brackets heretofore used, and is operated by a worm and wormwheel in place of bevel gears.

This machine has a capacity for sharpening hobs 4 in. in diameter and 4 in. in length, the wheel used is 7 in. in diameter. The work-arbor spindle is provided with a No. 8 B & S taper hole. Indexing plates for 10, 11, 12, 13, 14, 15 and 16 gashes are furnished and the machine occupies a floor space of 42x51 in. The net weight has been slightly increased by the addition of the heavier bed and table, that will aid in reducing vibration and improve the quality of the work.



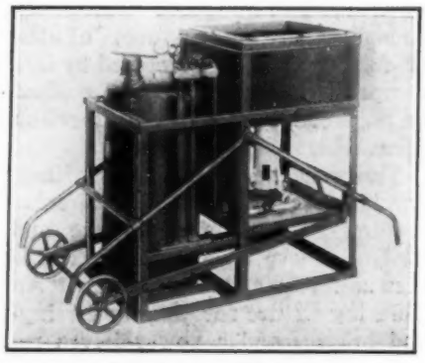


Figs. 1 and 2—Barber-Colman Automatic Hob-Sharpening Machine

Chausse Portable Furnace

The portable furnace illustrated, used for melting lead, babbitt, cyanide and other similar material, has been marketed by the Chausse Oil Burner Co., Elkhart, Ind. The unit is a combination of an oil-burning torch equipment and a retort mounted on a framework provided with wheels. The capacity, the portability and the economical operating features make this furnace suitable for a multitude of services.

The frame of the machine weighs 160 lb. empty, and its overall dimensions are 20 in. wide, 36 in. long and 33 in. high. The heating chamber is 14 in. square and 16 in. high, lined with fire brick that has a suitable flame entrance in the bottom portion. The kerosene tank has a capacity of 12 gal., sufficient for 12 hr. of operation at maximum temperature. The burners, consuming 1 gal. of fuel per hr., will deliver sufficient heat to melt 200 lb. of lead in from 20 to 30 min. The maximum temperature generated by the burners is 1,800 deg. F., and any reduction in this amount of heat will decrease the fuel consumption. Pressure on the tank is maintained between 10 and 20 lb. by a hand pump.



Chausse Portable Furnace

A feature of the machine is the mounting of the wheels, arranged so that when the forge is stationary it sets horizontally on its base. By lifting the handles at the rear, the wheels are lowered and the machine can be transported at will. The equipment has been found satisfactory for melting cyanide, case hardening, boiling water, heating pipe to be bent, expanding gears or collars and wherever an oil-burning furnace can be used to produce a high degree of heat.

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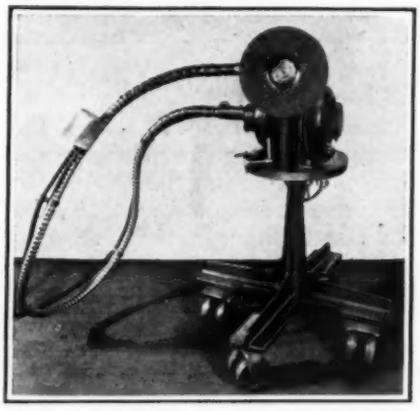
Carborundum Portable Sanding Machine

The portable sanding machine illustrated has been added to the line of grinding tools manufactured by the Carborundum Co., Niagara Falls, N. Y., permitting the disk-grinding head to be applied to the work from any desired position.

The motor is mounted on a cast-iron pedestal 24 in. high that is provided with a swivel table, permitting the swing of the motor half way around, or an arc of 180 deg. This feature adds to the adaptability



Carborundum Portable Sanding Machine

of the unit to any required position during a continuous grinding operation. The pedestal is balanced and supported by four double casters, so that a suitable movement and travel can be made without danger of upsetting. A holder mounted on the table provides a secure resting place for the machine head when not in use.

The machine is equipped with a 1-hp. motor built to specifications to meet the power conditions of the user. The flexible shaft that drives the grinder head is of a modern and approved type adapted to meet the working conditions of the machine. The main castings of the grinding head are made of aluminum to lighten the unit, yet give sufficient strength.

The assembly shafts and spindles are of steel supported in ball bearings to reduce friction to a minimum. Heat-treated, steel-mitre gears, running in an oil-tight chamber packed with grease, provide the angular drive from the flexible shaft. Provisions have been made for the lubrication of all moving parts. The grinding head is designed so as to be balanced when in use and is provided with two handles to render ease in operation.

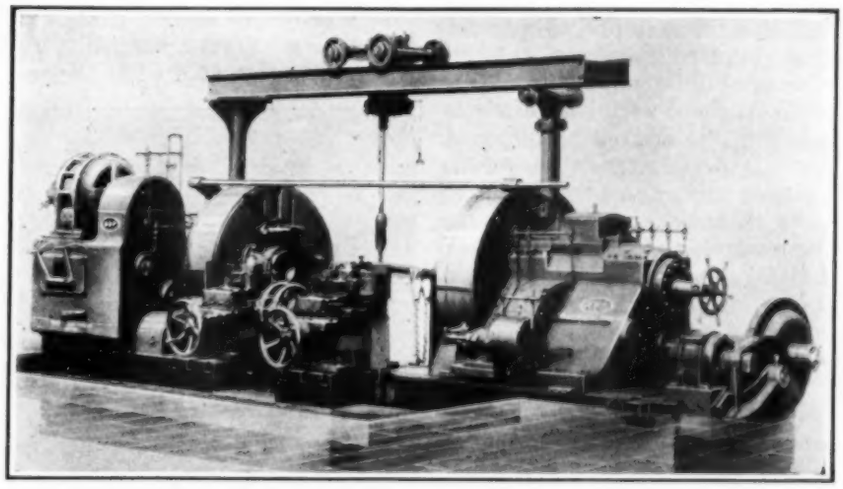
The disks used are coated with Aloxite, an aluminous abrasive, manufactured by the company. There is a definite clearance between the grains so that each grain comes in contact with the work. The grains are coated on a backing of cloth, that in turn is fixed to a fibre-board disk with a moulded-countersunk center punched with six pin holes that locate over the pins in the special lock nut, holding the disk securely to the sanding-machine head. These disks are furnished 9¼ in. in diameter. It is claimed that the construction of this machine permits unusual flexibility and that the driving mechanism eliminates vibration.

Niles-Bement-Pond Car-Wheel Lathe, No. 4

The car-wheel lathe illustrated has been placed on the market by Niles-Bement-Pond Co., 111 Broadway, New York, N. Y. The capacity is for the turning of wheels from 26 to 52 in. in diameter, mounted on axles having either inside or outside journals.

The left-hand headstock is stationary, suitably bolted to the lathe bed, while the right-hand headstock is moveable by a sliding fit on the bed that is provided with long shoes, sliding in T-slots at both the front and rear. The clamping surfaces of the T-slots are arranged with renewable steel liners. The faceplates of both heads, mounted on large spindles, are provided with internal gears driven in unison by pinions that are mounted on an auxiliary shaft located at the front of the machine on a line with the tools. A self-aligning ball-thrust bearing takes the end thrust of each spindle. Four semi-automatic drivers, having radial adjustment and fitted on each faceplate, are used for gripping work.

The right-hand headstock is operated by a screw that is driven by a separate motor. A safety feature, called a torque-limiting friction, is located on the end of the screw, made adjustable so that the drivers on the headstocks can be brought up against the work with the proper amount of lateral thrust for gripping. When the headstock is withdrawn the slip friction becomes a positive clutch. An electric switch is used as a safeguard against accident by limiting the lateral motion of this headstock.



Niles-Bement-Pond Car-Wheel Lathe, No. 4

Pneumatic power clamps, located at the front and the back, clamp the right-hand headstock to the bed. If air is not available, an electric-operated clamp may be used. The bed is constructed of heavy, deep, box section, reinforced by rigid box braces. The flat ways on the right-hand end of the bed, are provided with renewable wearing plates. The left-hand end of the bed projects beyond the driving head to accommodate an out-board bearing for the driving gear on the drive shaft.

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An automatic lubricating system is used, operated by a geared pump that keeps the oil level correct in a large tank, which is located in the upper part of the drive box. Trunk lines leading from this tank, that carry adjustable sight-feed lubricators, supply each bearing with the proper amount of oil. Gear trains are flooded with an unrestricted flow of oil continuously, and all the used oil from both headstocks drains to a reservoir under the floor where it is filtered and again pumped to the upper tank.

There are two four-sided flat-turret toolposts that carry the four cutting tools for roughing, flange roughing, flange and tread finishing, and chamfering operations, so arranged that when indexed to their cutting positions a minimum amount of horizontal adjustment is required. Each toolpost is mounted on a lateral feed slide that fits into the top surface of a cross slide. The wearing surfaces of both cross slides and lateral feed slides are covered by renewable hardened steel plates. The cross slides are mounted directly on top of bases that can be adjusted on the bed by a rack and pinion to accommodate different sized wheels. Four bolts clamp each base firmly to the bed in the desired position. A calipering device, consisting of an adjustable pointer on a bar supported by the headstocks, permits turning of both wheels to the same diameter.

Lateral feeds to both right- and left-hand toolrests are power operated. Feed ratchets are inclosed and so arranged that the feed may be thrown on or off by a pawl that also controls the direction of the feed. A feed-change disk is used for the six available feeds that vary from $\frac{1}{32}$ to $\frac{1}{16}$ inch.

Short ends of tracks, attached to a telescoping cover that extends between the face plates, line up with the shop tracks when the movable headstock is in the charging position. Wheel sets are then rolled in and raised by a pneumatic hoist for chucking.

The machine is driven by a 50-hp. motor mounted on the drive box with which it forms a self-contained unit. The drive box is totally inclosed and arranged so that a speed box of the constant-speed or adjustable-speed type is interchangeable with the headstock. The machine has been designed to eliminate all unnecessary losses, so that the maximum power available can be delivered at the tools. The construction is heavier and more powerful than any machine of this type previously built by the company. Its production is limited only by the tools used, and it is claimed that a reserve capacity capable of taking care of a 50 per cent increase in the present quality of tool steel has been built into the machine. The unit system of construction has been followed, making all parts accessible.

Perkins Blanking Presses

The Perkins Machine Co., Warren, Mass., has brought out a line of presses for piercing, blanking and general-purpose work on sheet metal that incorporates some notable features in the design.

The press is inclinable; pivoting upon the studs by which it is attached to the leg-frame at the front and supported at the rear by a jackscrew that is made permanently a part of the leg-frame and provided with a reversible ratchet wrench for convenience of manipulation. The frame is further secured at the rear

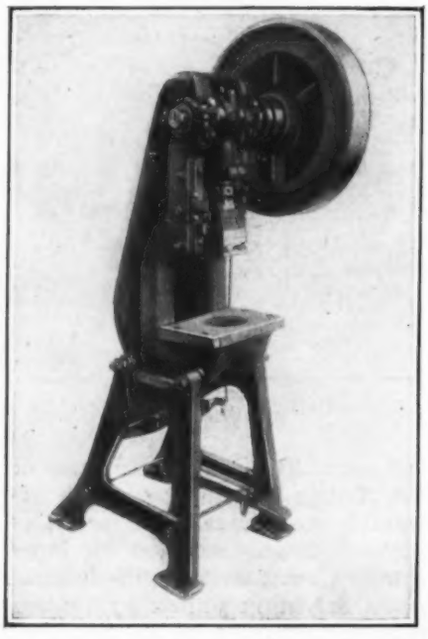

Fig. 1—The Perkins Blanking and Piercing Press

by self-tightening clamps so that continued jar from the action of the tools will not cause the jackscrew to work down.

The weight of the frame has been

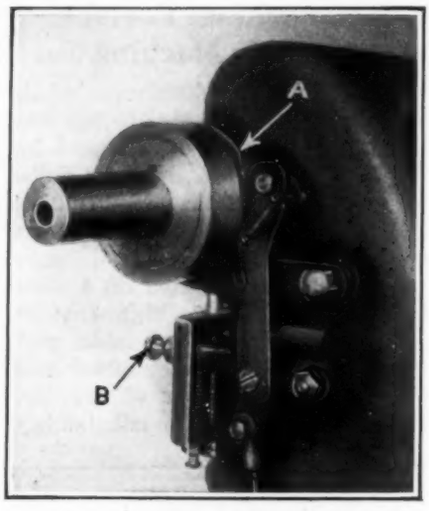

Fig. 2—Detail of the clutch

increased over the old design, the extra metal being distributed in the form of ribs on the inner sides of the frame in such manner as to provide maximum strength. The press is open-backed, but the sides are tied together behind the gate with a substantial web.

The pitman is provided with a double telescopic screw with right-and-left threads to facilitate positioning the gate to and from the bed. With this arrangement a $\frac{1}{2}$-in. movement of the screw adjusts the gate 1 in. The lower end of the pitman bears in a machined pocket at the top of the gate.

The caps of the main bearings and also that of the pitman are provided with felt wipers extending the full length of the respective journals, and suitable oil cups with self-closing covers keep the felts saturated with oil.

The design of the wheel is worthy of note; being a spoked wheel with a thin web between the spokes to prevent accident by reason of scrap becoming entangled therein. The central web does not, however, extend clear to the rim, but leaves an annular space through which a chain may be passed to facilitate handling the wheel with a chain-block or crane. Deep shrouds, extending inward from the rim, project beyond this opening and render the wheel to all intents and purposes a web wheel, while the presence of the shrouds enables the operator easily to grasp the rim for the purpose of turning the press when setting tools.

There are three clutch dogs in the

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wheel hub; each dog being a plain square section of steel, hardened and ground. The dogs may be driven out of the hub and replaced in any of the four positions, or they may be reversed end for end. This construction makes it possible to provide eight renewals before new dogs are necessary.

The clutch, shown in Fig. 2, is so designed as to make a repeat flow impossible. The curved yoke that withdraws the clutch-bolt is provided with a lip which extends over a corresponding projection on the bolt. When the latter once engages the yoke the two parts are locked together and the yoke cannot again be withdrawn until the revolution is completed and the press stopped.

By turning back an eccentrically-mounted cam roller at *A* the automatic withdrawal feature is thrown out of action and the press may be run continuously as long as the pedal is held down. A stop-screw at *B* may be turned in to keep the press in continuous action without reference to the pedal, as is desirable when using an automatic or roll feed and the machine allowed to run without an attendant.

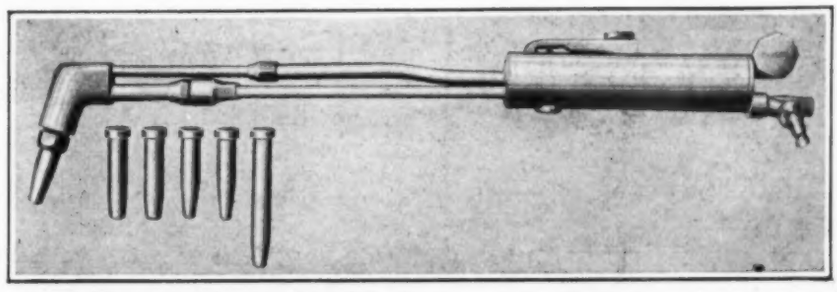
The press is made in nine sizes, plain and geared, ranging in weight from 380 to 15,600 pounds.

Milburn Low-Pressure Cutting and Welding Torch

A low-pressure torch for cutting and welding purposes has been marketed by the Alexander Milburn Co., 1416 West Baltimore St., Baltimore, Md. It will operate on either high or low-pressure gas with equal efficiency, and is suitable for use with acetylene gas, city gas or hydrogen.

The torch is made of bronze forgings and seamless tubing, and the tips of solid copper, are interchangeable with a large number of low-pressure torches of other makes. Welding can be accomplished, as well as cutting, by the application of suitable tips.

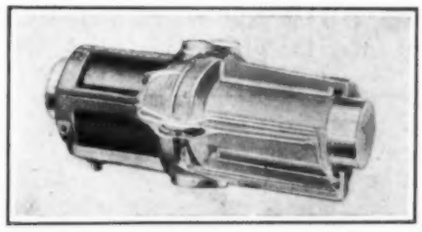
The manufacturers claim that this torch gives a correct and intimate mixture of oxygen and acetylene, resulting in a super mixture and non-flashback quality and that it will perform practically all the cutting and welding operations, within the range of the process, with efficiency and economy.



Milburn Low-Pressure Cutting and Welding Torch

Hill Collar-Oiling Bearing Cleveland Type

Since placing on the market several years ago the "Cleveland" type collar-oiling bearing, the Hill Clutch Machine & Foundry Co., Cleveland, Ohio, have made a redesign of this unit, that now contains improvements found necessary from experience.



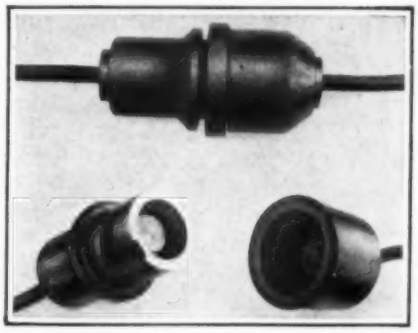
Hill Collar-Oiling Bearing, Cleveland Type

A positive oil feed and distributing system produces a forced oil circulation, giving an oil film that tends to lift the shaft free from all metal contact. This oiling is claimed to reduce wear and render more efficient results. The bearings require oiling only a few times a year, using a good grade of fresh oil.

The bearings are solid in construction and capable of withstanding heavy pressures. They are supplied with dust-proof ends, or heavy thrust ends when specified, and are built for shafting ranging from 1⅞ to 5⅛ in. in diameter.

Ohio Weatherproof Armored Cable Connectors

The Ohio Electric & Controller Co., 5900 Maurice Ave., Cleveland, Ohio, has added a weatherproof, armored cable connector to its line of electric specialties. The feature of this connector is that when the cable is soldered and tapped in each end, there are no live parts exposed and no tools are required for connecting or disconnecting.



Ohio Weatherproof, Armored Cable Connectors

Both halves are held together by a double-bayonet lock, so that a turn of but 15 deg. is required for making a disconnection. The copper-butt contact located in the lower half of the connector is movable and compressable so that it is free to adjust itself with respect to the fixed contact in the upper half. The turn required by the bayonet lock tends to give a positive wipe and keeps the surface of both butts clean.

Wissler Instrument Co. Purchases St. Louis Machine Tool Co.'s Products

The Wissler Instrument Co., 613 N. Broadway, St. Louis, Mo., has purchased the entire line of machinery and equipment of the former St. Louis Machine Tool Co., including the ball- and roller-bearing polishing machines, tapping machines, tapping chucks and the Western grinding and polishing machines. A complete line of repair parts for machines now in use may be obtained, in addition to the repair work that was formerly rendered by the St. Louis Machine Tool Co. It is the intention of the Wissler Co. to make any improvements and additions to this equipment that may be required.

SHOP EQUIPMENT NEWS

Rooksby Motor-Driven, Portable Cylinder-Boring Bar

The portable cylinder-boring bar illustrated has been marketed by E. J. Rooksby & Co., 1072 Hamilton St., Philadelphia, Pa. The principal features of the unit are the manner of driving the bar and the double-arm head.

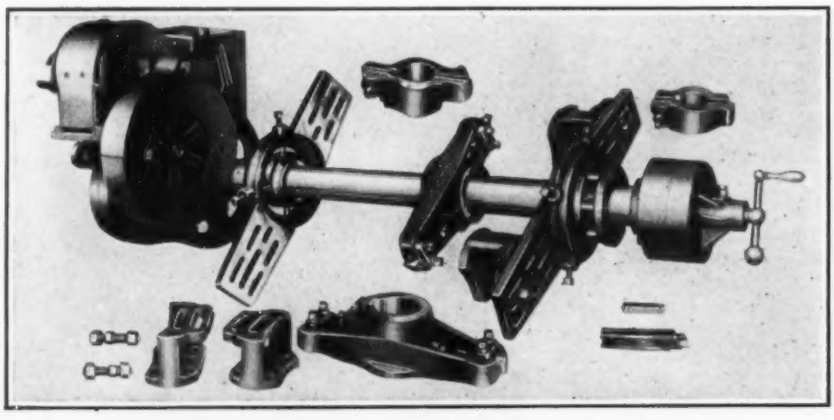
The motor is mounted on a suitable base on the gear-drive frame, forming an integral part thereof, the speed reduction being accomplished by gearing. The gear box, having shifting gears, is provided with several changes, giving a selection of cutting speeds suitable for cylinders of various diameters within the range of the bar. The gears have a positive-locking shifting device and are inclosed in a gear case and run in grease. The unit is furnished with either d.c. or a.c. constant-speed motors. If a variable-speed d.c. motor is desired, the speed-gear box is not required.

The main-gear drive is provided with safety guards that are cast integrally with the frame, adding to the strength and safety of the machine. The cutterhead is designed so that two tools may be placed on opposite sides of the bar. The cutterheads are fed along the bar by an inclosed feed box that is automatically operated and continuous in motion. There are two feed changes, accomplished by sliding gears controlled by a slip pin.

The machines are made in various sizes to bore valve-chamber bushings or cylinders ranging from 7 to 48 in. in diameter. The bars are made of machinery steel accurately finished to sizes of 3 to 6 in. in diameter. The weights of these units boxed for shipping range from 800 to 2,600 pounds.

The driving shaft can be furnished with either a Morse taper or with a straight shank for belt drive.

While this machine is primarily intended for use in locomotive repair shops, it is equally adaptable to any engine repair shop where cylinders and valve chambers are rebored.

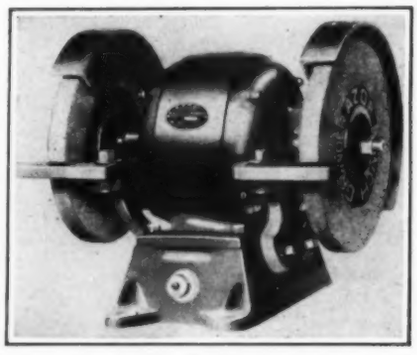


Rooksby Motor-Driven Portable Cylinder-Boring Bar

Azor Bench Grinder

Several changes have been made in the bench grinder manufactured by the Azor Motor Manufacturing Co., 7424 Bessemer Ave., Cleveland, Ohio, that was previously described on page 42, Vol. 62 of the *American Machinist*.

The motor has been increased in size, the guards have been changed to cover the greater portion of the rear part of the wheel, the operating switch now used is of the snap type and the wheels furnished have been increased from ¾x6 in., to ¾x8 in. in size.

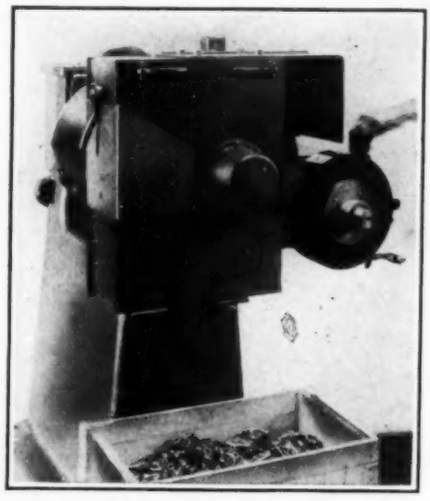


Azor Bench Grinder

Ransom "Rotomatic" Grinding Machine

The grinding machine illustrated, intended for the removing of gate burrs on small castings, has been placed on the market by the Ransom Manufacturing Co., Oshkosh, Wis.

In operation, castings are placed by hand in the revolving holder, then pass by the wheel and drop into a box on the floor. A 5-hp. motor that runs at 1,200 r.p.m. carries an 18-in. diameter wheel on one end of the spindle. On the other end is a gear box from which the feed is taken. The feed shaft can be operated at 1½, 2 or 2½ r.p.m. by the shifting of gears in the feed box by means of a handle. A push button is used for controlling the starter that is mounted in the base of the machine.



Ransom "Rotomatic" Grinding Machine

The top of the gear box has a hinged lid, permitting the oiling of necessary parts. The wheel guard is fixed with a hinged lid on the outside that can be lowered for the changing of the wheels. The back of the guard has a removable piece, so that the wheel can be reached for dressing. The wheel runs up in the front of the machine instead of running down. A cross feed is furnished so that the casting holder can be fed in or out to compensate for wear of the wheel. A quick trip is conveniently located so that the feed mechanism may be stopped instantly in case a casting does not fit into the holder satisfactorily. A holder suitable for any type of work is furnished with each machine.

News of the Week

Steel Treaters Hold Spring Sectional Meeting at Schenectady

Make several visits to industrial plants in vicinity

The three-day spring sectional meeting of the American Society for Steel Treating, held at Schenectady, N. Y., May 28-30, was well attended and was very satisfactory from every angle. The program was nicely balanced between technical sessions and shop excursions. During the first two days four plants were visited and nine papers were read.

The excursions included visits to the plants of the Ludlum Steel Co., at Watervliet; the Colonie plant of the Delaware & Hudson R.R.; the General Electric Co.; and the American Locomotive Company.

The first paper read, by P.A.E. Armstrong, vice-president of the Ludlum Steel Co., dealt with the subject of rustless steel. The other papers were the following:

The Relation of Crystal Orientation to Magnetic Properties of Silicon Steel, by W. E. Ruder, metallurgist, research laboratory, General Electric Co., Schenectady, N. Y.

Case Carburizing, by B. F. Shepard, metallurgist, Ingersoll Rand Co., Easton, Pa.

Results of Examination of Metals with the X-Ray, by Col. T. C. Dickson, commanding officer, Watertown Arsenal.

Manufacture of Guns by the Cold-Working Process, by Dr. F. C. Langenberg, director of laboratories, Watertown Arsenal.

The High Points in the Manufacture and Working of Steel, by L. F. Johnson, United Alloy Steel Corporation, Canton, Ohio.

On the Nature of Austenite and Martensite, by E. C. Bain, metallurgist, Union Carbide and Carbon Co., Long Island City, N. Y.

Manufacture and Heat-Treatment of Large Forgings, by A. O. Schaefer, Midvale Co., Nicetown, Philadelphia, Pa.

Determination of Heat-Treatment Costs and Furnace Efficiencies, by C. L. Ipsen, industrial heating department, General Electric Co., Schenectady, N. Y.

At the banquet, addresses were made by William Dalton, president of the Schenectady Chamber of Commerce; W. S. Bidle, president of the A.S.S.T.; Dr. W. R. Whitney, director, research laboratory, General Electric Co., Schenectady, N. Y.; and R. B. McColl, manager, American Locomotive Works, Schenectady, N. Y.

The last day of the meeting was devoted to a trip to Lake George.

Industry Must Serve Society in the Future, Says Alexander

Increase in mechanical and managerial efficiency

Addressing the members of the National Industrial Conference Board in New York recently, Magnus W. Alexander, president of the board, in reviewing the American economic situation, declared that we are at a turning point in our economic development and at the beginning of a new and different era. The following trends, already distinctly noticeable, are likely, in his judgment, to characterize the new period:

(1) Greater economic stability. (2) Stabilization in the character and growth of population, as a result of the new immigration law. (3) Relative industrial peace, with probable maintenance of the present high wage scale. (4) Increasing mechanization of industry under increasingly efficient management. (5) Increasing integration of industry and trade by way of consolidation and more direct distribution. (6) An increasing tendency to act only after searching inquiry into the facts. (7) Expansion of foreign trade. (8) Reaping of the fruits of well developed and efficient industrial organization by the consumer through lessened cost of production and simplified distribution.

"The task of the future will be to sustain the high level of production already attained, and to make further progress from this basis," said Mr. Alexander. "This task will not be easy, as it must be accomplished in a world that is becoming more complex in its organization, more keen in its competitive struggle and seemingly more nationally self-conscious. To be sure, as further development within our own borders becomes more difficult, the opportunity for further trade expansion in the international markets will exist and be open for development."

The new immigration law marked another breach with the past, Mr. Alexander pointed out. From approximately 1,000,000 immigrants a year which arrived during the decade preceding the war, the influx of aliens now has been reduced to about 168 000 in 1924. Thus even if the total quotas of every country are filled, the annual immigration will be no more than a fifth of what it was before the war.

One effect of restricted immigration already felt by industry he declared was the sustained high wage level.

Greater productive efficiency, due to greater mechanization of industry and increased managerial efficiency, Mr. Alexander said, had marked the last few years, partly induced by the lack of the cheaper foreign labor, now rapidly being displaced by machine power.

While the industrial and economic history of the United States hitherto has been one of growth to maturity, Mr. Alexander said in concluding, it is evident that now we are on the threshold of an era of service of industry to society. And all the signs point to it, he said, that in the coming years the people of the United States will reap the fruits of well developed, and well ordered industrial organization.

Manufacturing Efficiency Shows Big Increase

Manufacturing industries are making astonishing progress in efficiency, recent calculations show. Production of manufactured goods in 1923 was 65 per cent greater than that of 1914. The increase in personnel was only twenty-five per cent. While some other factors enter into the comparison the principal causes responsible are held to be increased efficiency in management, an increase in the skill of workers and the increased use of machinery.

High prices of materials and high wages have stimulated efficiency. Subsequent high prices of materials, however, stipulated their more efficient use.

The systematic effort to stimulate efficiency and sensible conservation has been known as the program for the "elimination of waste in industry." The term is not regarded as a satisfactory one as it conveys to the public an implication of wilful waste. Resort to the term "conservation" recalls that conception of conservation of which one manifestation was the tying up of the nation's waterpowers for a long period of years when they might have been producing new wealth.

Soviet Will Buy Automobiles

The Soviet Government has decided to purchase automobiles to the sum of 8,500,000 gold roubles, the make selected depending upon the winner in the International Motor Trials over a course of 5,300 kilometers in length, scheduled toward the end of July this year, says Assistant Trade Commissioner Emil Kekich, Helsingfors.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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LAST week I met an old friend whom I had not seen for some time. He is a very wealthy man whose wealth is largely due to his sagacity in the selection and purchase of investment securities.

I asked him the conventional Wall Street question, "What do you think of the market?" His answer was, "I never saw a situation that looked so flawless, but I am gradually converting everything I own into cash and I will soon be completely sold out for the first time since 1902."

When pressed for an explanation of his apparent inconsistency he said that he had none to offer, but added that "the sun cannot shine always" and that "the time to sell is when others want to buy."

This colloquy is quoted because there is some reason to think that it expresses the views of many shrewd men. The outlook is indeed almost flawless. The weakness of French francs is about the only blemish that is visible. On Wednesday they sold at 4.98¾ cents, and although they promptly went back to 5.01 the feeling is that Caillaux will have a hard time balancing the budget, in fact as well as in theory. Certainly his task has not been lightened by whatever Washington may have said to him about the debt due the United States, and it is not surprising to read that France may be compelled to increase her issue of paper francs in order to meet the unrenewable portion of the internal loans that will shortly become due.

But America's interest in French finance is almost an abstraction, and the decline in francs should not have any very serious effect here. Therefore, some other reason for the hesitancy of the stock market must be found and the only one that is at all satisfying is that the larger holders of securities are contentedly realizing.

This is not to say that there is any discernible indication of trouble, but long headed men cannot be forgetful of the fact that Congress will reconvene in about six months and that the Federal Reserve System, railroad rates and railway consolidations are among the questions that are certain to come up for discussion.

This is, however, a long distance view and it must be admitted that there is nothing immediately in sight to cause the slightest uneasiness. The prevailing feeling is in fact conservative and there is a noticeable lack of speculative initiative in the commodity markets as well as upon the Stock Exchange.

The grain markets advanced sharply on the cold weather, but they speedily relapsed into dullness. Cotton has been relatively quiet pending the issuance of the government report. Rubber and coffee are practically cornered. Consumers are wisely buying as little as possible, while speculators are closing their commitments. Sugar is about the only commodity in which the public interest is increasing. It is daily becoming more active and while prices are still at or near the lowest there is a growing feeling that the bottom has been reached.

But from the speculative apathy it is not to be inferred that business is poor. As far as can be judged there is an increased distribution of goods and more industrial capacity. A canvass of the dry goods trade revealed a half concealed optimism that was in surprising contrast with the published reports of curtailment among the cotton mills.

The active demand for spot cotton in New York and New Orleans is another helpful sign. A better demand for woolen and worsted goods is also reported and the decline in raw wool seems to have been arrested, at least temporarily. The production of automobiles is again breaking the record and the demand for steel and lumber appears to be reviving.

The only laggards are the coal business and the shoe industry. Both are still subnormal, but for different reasons. With coal it is a clear case of over-production or under-consumption, but the shoe manufacturers complain that shoes no longer wear out because every one rides in motor cars instead of walking as in the good old days.

These eddies in a stream that is otherwise tranquil are, however, inevitable. A condition of economic perfection cannot be hoped for. It is unattainable and even if it were attained it could not last for long. Therefore we should be profoundly thankful for the comparative stability with which we are now favored, while not forgetting that the law of change is the law of life and that nothing is exempt from its operation.

In Europe the situation is much as it is here except for the financial difficulties that the French government is facing. Sterling has sold as high as $4.86¼ and it is plain that London is reattracting the liquid capital that was formerly held there but was withdrawn during the war.

A speech made in New York by Sir Esme Howard, the British Ambassador to the United States, has attracted a good deal of attention. In it he intimated that Great Britain could not continue to buy in this country unless she could sell here also. It was interpreted as a protest against America's tariff wall and an intimation that it might be necessary to erect a similar structure around the British Empire. But the questions involved are presently regarded as academic in this country and there is not much likelihood of any change in the policy of our government.

A superabundant supply of bank credit is thus assured for many months ahead, and unless it is absorbed by a widespread revival of speculation a continuance of commercial stability and prosperity is to be expected.

What's Doing in Industry

The business outlook for June is favorable, according to analyses of authentic reports and statistics. There is nothing to cause uneasiness in the stock market, which is stronger and firmer than it has been in some weeks, and there is a noticeable absence of speculative movements. The machine tool market presents a brighter picture at the beginning of June than it did a month ago. In the Mid-West business has picked up and final returns for May showed a substantial increase in volume over the previous month. True, orders are not for large amounts, and are scattered, but the total is encouraging.

Agricultural machinery interests are enjoying better business than most of the other industries. Railroads are also buying a little more freely and have been active in seeking new shop equipment. In the East this is particularly true, several fair sized orders being placed in the past week.

Canada shows an improvement in machinery sales, industrial customers doing the bulk of the buying. Paper mills are expanding and railroad shops are busy, indicating a business season that should be quite profitable for machinery industries.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Cleveland

Cleveland manufacturers and dealers report business for the past fortnight as being fairly good. A slight lull was evident for a time but increased activity was noted in the past week. A review of the past two months business shows that May was slightly less than April. Producers are confident however, that June will equal any of the past months. An increased number of inquiries are reported, these coming from the automotive, railroad and metal working industries. A number of old inquiries have made their appearance again and manufacturers are hopeful that the "shopping around" period has passed and actual orders will result from these inquiries.

One outstanding feature of the past week was the opening up of the export market. Two orders were received for planers for sugar refinery plants in South America. Proposals have also been received from Spain and Panama.

Production in machine shops is on the increase. The American Plan Association has placed an average of forty men per day for the past two weeks. Wages in this particular trade have been increased from one to five cents per hour.

Cincinnati

For another week the trend of the machine tool business has been upward, practically all manufacturers and retailers reporting that the increase in demand was greater than the previous week. While the demand has not yet reached the point at which it may be called strong, it is good with the majority. The general feeling in all branches of the industry is that things are looking up and there has been a decided turn for the better.

Orders still continue to come in from the automotive industries, although in ordinary circumstances the buying season closes before this time. Railroads are not yet buying freely, but more orders were received this week than last, and more inquiries are coming in. A slight increase in export orders is also reported.

One firm reports that its increase this week has been in sales to concerns in the West and North, but others state that their sales have spread all over the country and that there is no great tendency for the demand to be better in one section than in another.

Industrial plants and general machinists have been ordering small tools quite freely, and also a considerable number of larger pieces of equipment. There have also been an increased number of orders for replacements during the week, coming from a scattered territory.

Practically all manufacturers and dealers state that May has turned out to be a much better month than they expected, and the entire trade feels greatly encouraged as to the outlook. While some dullness is expected in the summer, there seems to be a general feeling that business will be much better than it was at that time last year.

Chicago

There are noticeable indications that the machine tool industry is gradually improving, the total business reported in May by most houses being much better than that of April. Industrial demand is showing signs of increase, but it is the general belief that manufacturers in this district will not enter the market except for bare necessities until later in the year.

The head of one company dealing extensively in machine tools and equipment, when asked by the writer as to the industrial situation, said he had just finished looking over the reports of about a dozen of his salesmen who had been in nearby territories. These showed that the plants visited were fairly busy, but that their owners were not at this time ready to do any buying of moment. They said, however, that should production continue, even on its present basis, a considerable number of tools, either new or used, would be needed in the near future.

There is every reason to believe that the Illinois Central R.R. will this week give out its lists of awards on bids it has received, and dealers are expectantly awaiting this event. The Union Pacific R.R. quite recently made known the successful bidders for most of the equipment it is in the market for, and will soon announce those held over. The C. M. & St. P., which is in the hands of a receiver, has allowed an appropriation of $194,000 for machinery and tools. It is expected that most of this amount will be expended for second-hand equipment with which it will endeavor to get along as a measure of economy for the present.

Detroit

Steady sales of machinery and machine tools in the Detroit district warrant the presumption that the summer will find more activity in the industry than the corresponding period last year.

Demands for special machinery have been heavy to meet the constant increases in production on the part of the automobile and accessory plants in Detroit, Pontiac, Flint, Lansing, Marysville and other points in southeastern Michigan.

Machinery representatives state that sales have been very satisfactory during the past three months, with an absence of "spotty" periods. Apparently the only portion of machine tool activities which has not kept pace with the general trend has been that dealing with used tools.

Expansion of automobile plants continues to be the outstanding feature of Detroit's industrial activity.

In the latest bulletin issued by the Michigan Manufacturers' Association, John L. Lovett, general manager, says that "general manufacturing conditions are in splendid shape, reports from Detroit and all over the state showing a healthy and entirely satisfactory activity."

The Ford Motor Co. recently made a new all-time production record when the United States plants of the company turned out 7,858 Ford cars and trucks in the eight-hour working day. This record does not include foreign plants or associated companies.

Dodge, Hudson-Essex, Willys-Overland and Chevrolet are producing at the rate of more than one thousand cars a day.

One factor of decided encouragement to the machinery and machine tool dealers in Detroit recently has been the plans of the various sugar companies throughout Michigan to overhaul and enlarge their plants for the 1925 season. Quite a little new machinery is being purchased in this field.

Indianapolis

Demand for machinery and tools here remains somewhat spotted, with tool demand better than machinery. In view of general conditions in many industries the volume of inquiries is not what is expected. Some industries appear to be well settled in their production schedules and these, the trade here feels, should be making some inquiries. The volume remains small but there has been no noticeable decline in sales.

In spite of optimistic reports concerning the business volume being done by railroads in Indiana, dealers say the volume of tool purchases by both railroads and interurbans is below what it should be. The demand both for machinery and tools by fabricating plants is fair, indicating that these factories have sufficient orders ahead to keep operating for some time.

The automobile demand continues good. Most local factories are working, some at capacity and others under slightly curtailed production schedules. With these the tool sales are much easier made than machinery sales.

Only machinery that is absolutely necessary toward maintaining schedules is being considered. Auto factories in other sections of the state also report a good volume of orders. Local executives say there is every reason to believe that business will maintain a good volume for most of the summer.

Demand both for machinery and tools continues good with the farm implement factories. This is reported to be one of the best years these factories in Indiana have had since 1919. Used machinery dealers report a little increase in inquiries during the last two weeks, with some good sales in prospect.

New York

The local machine tool market has experienced a genuine improvement during the past week. As one prominent dealer expressed it—"We have had a modest but tangible increase in our business in the latter half of May and we judge by the nature of this business that it is of the character that will continue for some time."

Several more inquiries were recorded in the market last week. Most of these came from railroads whose purchasing offices are in this district. The lists are varied, all types of equipment being requested.

There is no definite knowledge as to when actual purchases will be made on these lists, but it is believed that some of the machines are urgently needed and will be bought within the next few weeks.

The D. L. & W. railroad placed orders for several machines, part of a list submitted to manufacturers some time ago. The first order included radial drills, two lathes, a boring mill and a planer. Another substantial order was received by a local manufacturer for a 72-in. forge lathe for one of the big plants of the Carnegie Steel Co. In addition to these items there were several smaller orders for single machines and other orders for small tools and shop equipment.

In the industrial market business has picked up considerably. Cranes and trucking machinery are moving freely and building contractors equipment has found a ready market.

The month of May as a whole showed a better tone in machine tool and equipment business, total orders being in advance of April. The outlook is better and June is expected to show even greater returns.

Canada

The general consensus of opinion is that the metal working industry in Canada will be particularly active during the next two or three months. Expansion programs in the pulp and paper, mining, automotive, and construction industries point to a substantial demand in the immediate future, while the advantageous prices reached on most lines is also expected to induce buying. In all parts of the country it is stated that sales of machine tools are increasing. Railway shops and automotive plants are creating the bulk of the demand.

Considerable business for engineering firms is being provided by the pulp and paper industry. Extensions on a large scale to the Backus-Brooks plants at Kenora and Fort Francis, Ontario, have been decided on, while it is announced that work on the plant of the Anglo-Canadian Pulp and Paper Mills, Ltd., near Quebec, which will have a capacity of 400 tons of newsprint per day, will begin shortly. The Dominion Engineering Co., of Montreal, is working on four newsprint machines for the plant of the International Paper Co., at Three Rivers, Quebec.

The automotive industry is unusually busy. While some executives have expressed doubt, many others, after mature consideration, have come to the conclusion that the restoration of the McKenna tariff in England, will have a favorable effect on Canadian production. It has recently been estimated that the production of automobiles in Canada reaches about $100,000,000 per annum. An estimate of the additional production of parts and other supplies places the output of this end of the business at about $25,000,000.

The volume of contemplated construction work reported since the first of the year is away ahead of the same period in 1924, being $224,063,000, an increase of $90,874,000.

Krupps Organizing for Future Industrial Activity

The Fredrich Krupp A. C. in Essen, Germany, has recently been reorganized, particularly in the administrative department. A large number of the directors have given up their positions, and the new executive committee will be composed of not more than three men. Mr. Viedfeldt, the former German Ambassador to the United States, has been re-elected to the board of directors and delegated to the executive committee as advisor on financial questions.

In the last eleven years Krupps has undergone several thorough reorganizations. In 1914 all production facilities at Essen to the last machine were adapted to the production of war material. In 1918-1923 the whole plant was turned back to peace production. In 1923 Ruhr occupation cut the factory off from its supply of raw materials and markets. In 1924 a final reorganization was begun.

The factories have been reorganized for the production of a large and varied line of articles, including moving picture machines, agricultural machines, textile machines, cash registers, etc. The big steel plant has been enlarged and developed for greater production.

During the war the total number of workmen in the Essen plant was 150,000, at the end of the war 117,000, and at present 35,000.

It is evident from these figures that a considerable part of the production plant is not being used at the present time. The company is considering concentration on a smaller line of products and the removal of a large number of items from the manufacturing program.

New England

Orders for special machinery are increasing and current demands are keeping builders of these products in machinery centers of the New England territory, particularly those in the Connecticut section, at a comfortable production pace. There is additional evidence of maintenance of satisfactory trade in the automobile industry and orders in good volume are being placed. Representatives of both these branches of trade state that spot deliveries are sought and early shipping dates are specified.

Builders of special machinery are experiencing a substantial volume of business from the manufacturers of glass. This business, which has been good for the past three months, assumed greater proportions in the last month. Orders are emanating from St. Louis, Pittsburg, Ohio and New Jersey, principally, and are not localized.

Manufacturers of punch presses are finding an increasing demand for their products for export shipment, with Germany, Italy and Japan as the leading buyers. The export business continues to show improvement month by month and inquiries are such as to indicate further expansion of this class of business.

Drilling machines are in good demand by the automobile trade without any particular section of the country conspicuously outstanding.

Sales of machinery in this territory are reported to be better than in May a year ago, and the outlook continues favorable.

Railroads Spent Nearly Five Billions in 1924

Expenditures made by Class I railroads in 1924 for wages, materials and supplies and for improvements totaled $4,847,700,000, according to reports for the year just received by the Bureau of Railway Economics.

A large part of this sum went directly to the industries of the United States though which source it reached the wage earners, contributing, to a large extent, to the prosperity of the nation.

This amount, however, does not include approximately $340,000,000 paid in taxes by the railroads. It also does not include $510,000,000 paid out in interest charges by the Class I carriers or $310,000,000 paid out in dividends during the period.

The total principal expenditures of the railroads in 1924 was a decrease of $735,400,000 compared with 1923.

Of the total amount, the railroads paid out $2,629,902 in wages for operation and maintenance work during the year while capital expenditures, including new equipment and improvements, totaled $874,743,000.

More than 27 per cent of the total steel production of the United States was purchased directly by the railroads, or for them through equipment manufacturers, in 1924. Total expenditure for iron and steel products made direct by the railroads during the year was $365,610,000.

Agitation Grows for Better Management of Patent Office

Greater liberality on the part of Congress in the matter of appropriations has improved the Patent Office situation somewhat, but it is recognized that the trouble is not all due to lack of funds. The need for certain changes in procedure is apparent as is the need for better management. Procedure now being followed requires eighty-five per cent of the time of the commissioner, the executive officer of the bureau, for hearing appeals. As a consequence very little time is left for the consideration of executive duties.

Theoretically the Patent Office is only seven months behind in its work—a decided improvement over the situation a year or two ago.

Lawyers Object

Means of improving practice on the administrative side now are being considered. One way would be to relieve the commissioner of part of his judicial functions. To this the patent lawyers object. They seem to think the present cumbersome appeal machinery is necessary. A question raised by the examiners, under present procedure, can be appealed to a board of examiners, then to the commissioner, then to the Supreme Court of the District of Columbia, then to the Court of Appeals, and finally to the Supreme Court of the United States. Some think "six jumps to justice" are too many and that the commissioner, at least, could be eliminated.

If it is necessary to continue the commissioner as one of the rungs for the up-climing of contention, it is suggested that an administrative officer could be set up.

Need for Working Clause

The great question, however, in the whole patent situation is whether or not a working clause shall be required. Other industrial countries require the commercial production of the article patented within certain time limits. This makes it necessary for American inventors to start manufacturing plants all over the world.

On the other hand Germany and England, for instance, by taking out patents here can prevent manufacture in this country. Documents exposed by the war showed to what an extent Germany used chemical patents to prevent manufacture in this country.

At the forthcoming conference at The Hague this country is determined that some agreement must be worked out which will guarantee equality of treatment to American inventors. Thought also is being given a proposal that foreign inventors be required to manufacture in this country three years after the article has been in commercial manufacture in any other country.

The third alternative is to put in an out-and-out working clause. This, however, works a great hardship on the inventor whose idea antedates the time when its commercial application is possible.

Defense Day Changed

Following the announcement from the White House that President Coolidge disapproved of the holding of "Defense Day" ceremonies on Armistice Day, Dwight F. Davis, Acting Secretary of War, wrote to the President and stated that the celebration this year will take place on the Fourth of July. In his letter Mr. Davis said:

"I have received your letter suggesting July Fourth for the Defense Test. The original recommendation of Armistice Day for this event was made by representatives of the civilian components, and for the convenience, not of the military, but of the civilian participants, as it was thought desirable to hold it on a day during the Fall convenient to industry, and associated with the World War.

"As objections have been raised to this day and it has been disapproved by you, I will issue immediate instructions to hold the patriotic Muster Day on July Fourth this year."

At the present writing no definite or official orders have been issued by Washington, and it is generally believed that there will be no muster of industries on account of the holiday season.

Machinery Exports Almost Doubled in April

Imports and exports of metal-working machinery during April, with revised comparative figures for April, 1924, as compiled by the Department of Commerce, are as follows:

	April, 1924 Value	April, 1925 Value
Lathes	$86,850	$203,730
Boring and drilling machine tools	28,866	89,784
Planers, shapers and slotters	14,438	36,215
Bending and power presses	22,471	45,162
Gear-cutting machines	43,695	70,017
Milling machines	30,524	124,901
Thread-cutting and screw machines	32,570	140,241
Punching and shearing machines	9,753	18,009
Power hammers	10,963	15,402
External grinding machines	50,270	243,573
Internal grinding machines	4,297	84,236
Other grinding and sharpening machinery	46,997	50,144
Chucks for machine tools	23,088	39,210
Reamers, cutters, drills, taps, dies and other metal-working tools	145,594	218,704
Pneumatic portable tools	105,156	88,010
Foundry and molding equipment	11,813	95,705
Other metal-working machinery and parts of	382,973	477,719
Metal-working machine tools (total)	$1,050,318	$2,040,762

Bids Asked for Air Mail Service

Bids for a contract air mail service between Kansas City and Chicago will be asked for within a few days. The action will form the first actual step in the Post Office Department's program to spread a net of air service routes over the United States. The contract air mail service will differ from the government financed system in that the carriers will be privately controlled, collecting their compensation through the department out of the air postage fees.

Personnel Shift in the Niles-Bement-Pond Organization

The general sales and accounting departments of the Niles-Bement-Pond Co., which have been located at 111 Broadway, New York, have been removed to Hamilton, Ohio, where one plant of the company is situated. At the same time the sales and accounting departments of the Pratt & Whitney Co., which have been associated in the same offices with the Niles-Bement-Pond organization, have been removed to the plant at Hartford, Conn. The general executive offices of the two companys will remain at the New York address.

Harold F. Welch, who has been in charge of sales in the New York district, has been appointed general sales manager and has been transferred to the Hamilton office. W. P. Kirk, who has been assistant general sales manager of the two companies, has been appointed general sales manager of the Pratt & Whitney Co. George G. Greist, general manager of the Niles Tools Works at Hamilton, has been made general manager of the Niles-Bement-Pond Co., and is in charge of the Hamilton office.

There have been several other changes in personnel, including the resignation of C. L. Cornell as vice-president. He is succeeded by C. K. Seymour, secretary of the two companies, in which capacity he will continue. E. L. Leeds, formerly general sales manager, has been appointed a vice-president and will be in charge of the sales for both companies, making his headquarters in New York.

Business Items

The Hilo Varnish Corporation, of Brooklyn, N. Y., announces the opening of a new branch office at 218 Third Ave., Pittsburgh, Pa. Greater storage facilities are available at this address. A. G. Russell will have charge of the industrial field and Ben Bower will care for the dealer and jobber trade.

The American Manganese Steel Co., of Chicago Heights, Ill., has completed its manufacturing plant located in Los Angeles, Calif. This plant is the most recently established unit of a chain of six foundries now owned by this company, the others being at Chicago Heights, Ill.; New Castle, Delaware; St. Louis, Mo.; Denver, Colo.; and Oakland, Calif. The organization now has facilities for producing about 25,000 tons of manganese steel castings annually.

The Simonds Saw and Steel Co., of Fitchburg, Mass., has established thirteen service stations and repair shops. They are located in the following cities: Boston, Mass.; New York City; Detroit, Mich.; Chicago, Ill.; Memphis, Tenn.; New Orleans, La.; San Francisco, Calif.; Portland, Ore.; Seattle, Wash.; Montreal, Que.; Toronto, Ont.; St. John, N. B., and Vancouver, B. C.

Sale of the Hupp Motor Car Corporation body plant at Racine, Wis., to the Murray Body Corporation, of Detroit, has been announced by Charles D. Hastings, president and general manager of the former company. Under the terms of sale, the Murray company is given a five-year contract to make all Hupp bodies. Capacity of the plant, which comprises five buildings, is from 60,000 to 70,000 motor car bodies per year. All Hupmobile bodies hereafter will be made in Detroit by the Murray organization.

Rogers, Brown & Co., of Cincinnati, announce the merger of their organization with Crocker Bros., of New York. Both firms are distributors of pigiron, coke, ore and ferro alloys. The two firms have formed a corporation and will take over the entire business control of the former organization. The main office will be in New York.

The Bridgeport Die and Machine Co., of Bridgeport, Conn., has been ordered sold by the Federal Referee in the bankruptcy proceedings instituted against the firm.

The Stephens-Adamson Manufacturing Co., of Aurora, Ill., manufacturer of conveying, transmission and screening machinery, has opened a sales and engineering office at 621 Wells Fargo Express Bldg., Second Street, San Francisco, Calif. This office will be in charge of Charles E. Bruff, formerly of the mining engineering firm of Bradley, Bruff & LaBarthe.

John Lavelle, of Anderson, Ind., head of the Lavelle Foundry Co., announces the re-opening of the plant in Indianapolis. The Indianapolis branch has been closed down for a short time. Business, according to Mr. Lavelle, is improving and the three plants, two in Anderson and one at Indianapolis, are to operate steadily.

The Pittsburgh Screw and Bolt Co., of Pittsburgh, Pa., has purchased the Continental Bolt and Iron Co., of Chicago. The newly acquired plant will be merged with the Gary plant of the Pittsburgh company.

The New York office of the Kearney & Trecker Corporation, of Milwaukee, has been moved from 50 Church St., to 149 Broadway. W. H. Lotz is in charge of this branch.

The recent announcement of the sale of the Lumen Bearing Co., of Youngstown, Ohio, to the Falcon Bronze Co., of that city, raised the question of the Buffalo company's relation to the Youngstown corporation. This sale does not change the status of the Lumen Bearing Co., of Buffalo, as it is a separate and distinct New York State corporation.

The Youngstown company was organized under the laws of the State of Ohio about six years ago. The Buffalo company was a minority stockholder and some of the individual stockholders of this company were also stockho'ders in the Youngstown corporation.

The Lumen Bearing Co., of Buffalo, will continue to manufacture nonferrous castings, babbitts, solder and ingot metals.

Personals

FRANK RIFFLE has been transferred from Milwaukee to the New York office of the Kearney & Trecker Corporation.

P. T. FARREL has been appointed assistant to the general purchasing agent of the Youngstown Sheet and Tube Co., Youngstown, Ohio.

J. W. FREY has been appointed manager of the new Detroit office of the Landis Machine Co., of Waynesboro, Pa. This office is located at 5928 Second Blvd.

JAMES L. HAYNES has been employed as industrial engineering specialist for the Hyatt Roller Bearing Co., Harrison, N. J.

ARTHUR W. WEISE has been appointed manager of the Philadelphia office of the Strom Ball Bearing Manufacturing Co., of Chicago. Mr. Weise will be located at 309 Lincoln Bldg., in Philadelphia.

VERNE MONROE has been placed in charge of the recently organized Cameron Tool and Supply Co., of Wheeling, W. Va.

H. E. NEUBAUER has become associated with the Chemical and Vacuum Machinery Co., Inc., as chief engineer. Mr. Neubauer was formerly assistant chief engineer for the Buffalo Foundry and Machine Co.

MARC STERN has resigned as director of sales for the Doehler Die Casting Co., Brooklyn, N. Y.

PAUL M. TYLER, of the technical staff of the United States Tariff Commission, is engaged in field work in connection with the commission's investigation of scientific instruments.

WILLIAM E. HOLLER, formerly vice-president and general manager of the Flint Motor Co., has joined the sales department of the Chevrolet Motor Co.

GUISEPPE FACCIOLI, engineer of the Pittsfield plant of the General Electric Co., will sail on June 6 for an extended trip through Europe. Mr. Faccioli plans to motor through France, Germany, Austria and Czecho-Slovakia, followed by a visit to relatives in Italy. He will attend the third International Conference on High Voltage Systems, to be held in Paris.

ROBERT A. WILSON has been appointed chief engineer for the Hoefer Manufacturing Co., of Freeport, Ill. Mr. Wilson was formerly associated with the Baush Machine Tool Co., and for the past two years was in charge of the Chicago office of that concern.

A. P. EMMERT has resigned as general superintendent of the plant of the Warner Gear Co., of Muncie, Ind., and has taken charge of the axle plant of the Hudson Motor Car Co. in Detroit.

W. C. MACFARLANE, of Chicago, has been elected vice-president and appointed general manager of the Minneapolis Steel and Machinery Co., of Minneapolis.

JAMES MURRIE has been appointed superintendent of the Columbiana Foundry Co., McKeesport, Pa.

R. D. LANDRUM has been appointed general manager of the ceramic materials department of the Titanium Alloy Manufacturing Co., Niagara Falls, N. Y.

OTTO NORDSTROM, mechanical engineer of Sundsvaal, Sweden, inventor of the Nordstrom wood-refuse drying tower, has sailed for home after spending two months in Canada in connection with proposed installations of his tower, for which Vickers and Combustion Engineering, Ltd., Toronto, holds the Canadian rights.

A. J. BRANDT has been appointed works manager of the Oakland Motor Car Co. Mr. Brandt is a graduate of the Case Scientific School, and has been associated with Oakland for several years.

Obituaries

JOEL W. BURDICK, chairman of the board of directors of the West Penn Steel Co., died on May 12.

DOUGLAS P. COOK, president of the Boston Pressed Metal Co. and president of the Worcester branch of the National Metal Trades Association, and former president of the National Pressed Metal Association, died on May 26 at his home in Worcester, Mass., from an attack of heart disease. He was a native of Worcester, forty years old, a graduate of Worcester Academy and of Harvard in 1905. He was elected president of the National Pressed Metal Association in 1917.

SIR WILLIAM FLETCHER BARRETT, scholar and scientist, died in London, England, on May 27. He was eighty-one years of age. Sir William founded the Society for Psychical Research and formerly was its president. He discovered in 1899 certain magnetic and electrical properties of the silicon-iron alloy, now known as stallory, which has been of much value in electrical engineering for the construction of transformers and dynamos. His writings covered a wide field of philosophy, science and psychical researches.

GEORGE P. DRAVO, president and treasurer of the George P. Dravo Co., of Milwaukee, died on May 11. Mr. Dravo was prominent in engineering circles. He was the first president of the Milwaukee Engineering Society and a life member of the American Society of Mechanical Engineers.

ELBERT C. FISHER, vice-president and general manager of the Wickes Boiler Co., of Saginaw, and nationally known as an engineer and designer of steam boilers, died May 18 after a short illness.

ANTHONY J. HORTON, production manager for the Noiseless Typewriter Co., at Middletown, Conn., died on May 23. He was fifty-one years old.

WILLIAM C. HAWKINS, managing director and secretary of the Dominion Power and Transmission Co., died recently at Echo Beach, Ontario, in his 60th year. Mr. Hawkins was born at Orange, N. J. Before moving to Canada in 1901, he lived in Schenectady, N. Y., for a number of years, where he acted as consulting engineer for many large electrical developments.

PERCY GIFKINS, former general manager of the Dominion Atlantic Railway, died at his home in Kentville, Nova Scotia, on May 24. He was seventy-six years old.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Construction machinery and equipment. Hungary. Purchaser and Agent. Reference No. 14912.

Metallurgic and mining machinery. Belgium. Agent. Reference No. 14925.

Agricultural machinery. Italy. Agent. Reference No. 14850.

Case-hardening materials. Germany. Purchaser. Reference No. 15060.

Metal working machinery. Germany. Purchaser and Agent. Reference No. 15056.

Machine tools. India. Purchaser and Agent. Reference No. 14981.

Conveyors, gravity, portable and bucket. Panama. Purchaser. Reference No. 15065.

Tempered rolled steel. France. Purchaser. Reference No. 15003.

Motors and generators, electrical. Japan. Agent. Reference No. 14982.

Machinery, all kinds. Japan. Agents. Reference No. 14982.

Small tools. Japan. Agent. Reference No. 14982.

Engines and tractors. Uruguay. Purchaser. Reference No. 15290.

Pumps and cranes. Belgium. Agent. Reference No. 15190.

Cranes, steam machinery, Diesel engines and metal working machinery. Brazil. Agent. Reference No. 15183.

Machinery for sheet iron working. Czechoslovakia. Agent. Reference No. 15193.

Machine tools. France. Agent. Reference Nos. 15182, 15186, 15187.

Small tools. France. Agent. Reference No. 15187.

Machinery, machine tools and wood working machinery. Germany. Agent. Reference No. 15178.

Beltings and packings, machine tools and transmission machinery. Austria. Purchaser and agent. Reference No. 15110.

Machine tools and small hand tools. German. Agent and purchaser. Reference No. 15190.

Machine tools, blacksmith shop equipment and smelting plant machinery. Poland. Purchaser. Reference No. 16106.

Trade Catalogs

The Micro Way. The Micro Machine Co., Bettendorf, Iowa. A nineteen-page booklet dealing with the reconditioning of pumps, bringing out one of the ways in which the Model D-G internal grinder made by this company can be used. The data and instructions are arranged in departments, or chapters, each step being covered thoroughly. Excellent illustrations make it easy to understand the process as described. Attached to the catalog is a four-page circular describing the new Model "F. G." internal grinder, giving complete specifications and records of performance of this machine.

Tructors. The Elwell-Parker Electric Co., Cleveland, Ohio. Catalog No. 140. A well-made up catalog of forty pages, profusely illustrated, giving detailed information about the various types of electric storage battery industrial trucks, tractors and cranes. Each type is fully described in detail, and illustrations are included which show the vehicles in operation.

Big Jobs Book. The Dodge Manufacturing Corporation, Mishawaka, Ind. An elaborate booklet visualizing the engineering, foundry and machine shop facilities of this company which are available for the manufacture of special machinery and equipment. The book also shows a wide range of special equipment made by this company. The book is really a miniature rotogravure edition, each page being a finely reproduced view of sections of the shops, the yards and the uses of the machines and equipment.

Short Cuts in Metal Drawing. The Marquette Tool and Manufacturing Co., Chicago, Ill. This booklet gives an interesting history of several problems in sheet metal drawing and forming operations using pneumatic die cushions. The book shows a few representative examples of these operations, explaining in detail the machines and processes of the work. Illustrations help the reader visualize these operations.

Multiple-spindle Chucking Machine. The Goss & De Leeuw Machine Co., New Britain, Conn. A twelve-page circular describing and illustrating the new improved multiple-spindle chucking machine as manufactured by this company. The effort is made to show a machine that combines maximum production with high accuracy and the pages give detailed information regarding the construction of the machine, its operation and the work it produces. All the important parts of the machine are illustrated.

Sloan & Chace Precision Tools. The Rice Machine Tool Corporation, Newark, N. J. A beautifully bound fifty-page catalog describing the various machines, tools and precision machinery made by this company. The book is divided into sections under the following headings: Bench Lathes and Attachments, giving information and illustrations of milling attachments, screw cutting, slide rest, boring rest, steady rest, toolpost grinder, grinding attachments, tailstock with spindles, collets and chucks: Bench Milling Machines, Automatic Gear and Pinion Cutters; Drill Presses and Tapping Machines; Countershafts; Special Machine Tools, Fixtures, Jigs and Dies. Each type is illustrated both with halftones and separate line sketches showing details of construction.

Calendar of Local Meetings

American Society of Mechanical Engineers

Birmingham, Ala. June 16. Inspection of mills. Avondale Cotton Mills.

Philadelphia, Pa. June 16. Joint outing with A. I. E. E.

Atlanta, Ga. June 18. Supper meeting and election of officers.

Denver, Col. June 26. Regular business meeting and election of officers. Excursion to radio stations in Denver.

Portland, Ore., June 22 to 25. Pacific Coast Regional Meeting.

National Association of Cost Accountants

Milwaukee Chapter. June 9. Annual banquet.

Philadelphia Chapter. June 12. Subject: "Advertising Budget." How it is lined up and operated. Who pays for it?

Twin Cities. June 11. "Cost of Government." Annual election of officers.

Western Massachusetts. June 23.

Worcester. June 11. "Applied Economics."

Hope Courts Will Clarify Trade Body Statistics

While the two cases involving trade statistics which are pending before the Supreme Court of the United States do not call, necessarily, for any clear-cut pronouncement, the hope is expressed that the justices may see fit to clarify the situation by some expressions of opinion that are broader than the cases before them.

The new Attorney General is understood to be following a liberal policy in this connection. Trade associations in doubt as to the legality of their statistical or other plans are being encouraged to submit any question they may have to the department. If the proposed activity is objectional a statement to that effect probably will be forthcoming.

Forthcoming Meetings

National Association of Cost Accountants. Sixth international cost conference, Detroit, Mich., June 15, 16, 17 and 18. Headquarters at Hotel Statler. Secretary, Stuart C. McLeod, 130 West 42nd Street, New York City.

Division V of the American Railway Association. Business meeting June 16 to 18, Chicago. V. R. Hawthorne, 431 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19. C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., in August. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

Association of Railway Supply Men. Annual convention and exhibition. Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. Earl E. Thulin, secretary, the Duff Manufacturing Co., 715 People's Gas Bldg., Chicago.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

Production Meeting Society of Automotive Engineers. Sept. 14, 15 and 16. In conjunction with American Society for Steel Treating. John Younger, chairman; G. F. Clarkson, secretary, 29 West 39th St., New York City.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig iron market firmer at present levels; there is continued improvement in tone. Steel demand is most active in bars, rails and tin plates. General tendency of the steel sheet market is toward a rise of about 5c. per 100 lb. above the quoted minimum on black and galvanized. Steel bars hold firm at $2 per 100 lb., Pittsburgh. Shapes and plates range from $1.90 to $2.10 per 100 lb., which level prevailed a month ago at Pittsburgh mills.

Non-Ferrous Materials—Copper firm at May 22 level in New York warehouses; lead up ⅝c. and zinc, ¼c. per lb. Tin market is trifle weaker abroad; opposite condition prevails in antimony.

(All prices as of May 29)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	20.00@22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	23.26
Virginia No. 2	29.17
Basic	22.26
Grey Forge	22.75
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	22.77
Basic	22.77
Bessemer	22.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.40@2.50	3.89	3.15	3.80
No. 12	2.45@2.55	3.94	3.20	3.85
No. 14	2.50@2.60	3.99	3.20	3.95
No. 16	2.60@2.70	4.09	3.35	4.15
Black				
Nos. 17 to 21	2.95@3.30	4.15	3.95	4.30
Nos. 22 to 24	3.00@3.35	4.20	4.00	4.35
Nos. 25 and 26	3.05@3.40	4.25	4.10	4.40
No. 28	3.15@3.50	4.35	4.15	4.50
Galvanized				
Nos. 10 and 11	3.25@3.60	4.35	...	4.50
Nos. 12 to 14	3.35@3.70	4.45	....	4.60
No. 16	3.50@3.85	4.60	....	....
Nos. 17 to 21	3.65@4.00	4.75	....	4.90
Nos. 22 to 24	3.80@4.15	4.90	4.75	5.05
No. 26	3.95@4.30	5.05	4.90	5.20
No. 28	4.25@4.60	5.35	5.20	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
⅛ to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	⅞	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05	8.00	7.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	7.85
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.25c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb. Chicago, 3/32, 8.85c.; ⅛, 7½c.; ¼, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.12½
Tin, 5-ton lots, New York			56.00
Lead (up to carlots), St. Louis	8.40	New York	9.37½
Zinc (up to carlots), St. Louis	7.10	New York	8.00

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.00	19.00	....
Copper sheets, base	21.75	21.75	22.00
Copper wire, base	19.25	16.00	20.00
Copper bars, base	20.87½	20.75	22.50
Copper tubing, base	23.75	24.75	24.00
Brass sheets, base	18.12½	18.62½	18.37½
Brass tubing, base	22.75	25.25	26.00
Brass rods, base	15.87½	16.37½	18.37½
Brass wire, base	18.62½	20.12½	20.00

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	27.00
Zinc sheets (casks)	11.00	11.25	11.37
Solder (½ and ½), (case lots)	39.50	36.50	....
Babbitt metal (83% tin)	60.00	65.00	50.00
Babbitt metal (35% tin)	28.00	20.50	28.00
Nickel (ingots) f.o.b. refinery	31.00	....	....
Nickel (electrolytic) f.o.b. refinery	38.00	....	....
Nickel (shot) f.o.b. refinery	32.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel Metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.00@11.50	11.25	10.25
Copper, heavy, and wire	10.75@11.00	11.00	10.25
Copper, light, and bottoms	9.25@9.75	9.00	9.00
Heavy lead	6.25@6.50	6.25	6.50@6.75
Tea lead	5.25@5.50	3.75	5.50@5.75
Brass, heavy, yellow	6.75@7.25	6.50	7.00
Brass, heavy, red	8.50@8.75	8.75	8.00
Brass, light	5.75@6.00	5.50	6.00
No. 1 yellow rod turnings	7.25@7.50	7.00	7.75
Zinc	4.00@4.25	3.50	4.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.00
"A" Grade:				
IC,	14x20	8.85	9.40	8.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	6.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14
Cotton waste, colored, per lb.	.10@.15½	.18	.09½
Wiping cloths, 13¼x13¼, per lb	.17¼	36.00 per M	.11*
Wiping cloths, 13¼x20½, per lb.	....	45.00 per M	.11*
Sal soda, per 100 lb. keg	2.25	2.25	2.00
Roll sulphur, per 100 lb. keg	3.60	3.75	2.85
Linseed oil, per gal., 5 bbl. lots	1.09	1.21	1.23
Lard cutting oil, 25% lard, per gal.	.55	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5%	20–5%	20–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0349
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb	.1587½	.1587½	.145
Solder (½ and ½)	per lb.	.395	.37	.3475
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (⅛ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.55	.60	.55
Machine oil	per gal.	35	.33	.29
Belting, leather, medium	off list	30–10%	30–10%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$5.00
Emery paper	10.71	11.00	11.00
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.50
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag		.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.00@3.25
Coke, prompt foundry, Connellsville	per net ton		3.75@4.25
White lead, dry or in oil	100 lb. kegs		New York, 15.75
Red lead, dry	100 lb. kegs		New York, 15.75
Red lead, in oil	100 lb. kegs		New York, 17.25

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x¼-in., 2c. each. Discount 70% for $\frac{3}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ¼x¼-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ⅞-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4$\frac{1}{16}$-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ⅜-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c., longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅜-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Conn., Bridgeport—Bd. of Education, State House, Hartford—woodworking machinery, tools and equipment for school here.

Mass., Auburndale (Boston P. O.)—C. N. Wood, 25 Central St.—woodworking planer.

Mass., Boston—Nathan Milrod, 116 Cummington St.—repair tools and general equipment, for service garage.

Mass., Boston—O. Whyte, 73 Cornhill—spot welder, to weld two pieces ¼ in. thick; arc welder, medium capacity.

Mass., Boston—R. R. Wilson, Jr., 281-83 Ruggles St.—miscellaneous tools and equipment for repair and service garage.

Mich., Battle Creek—The H. B. Sherman Mfg. Co., 12-20 Barney St.—machinery and equipment for large foundry and brass finishing shop.

Mich., Detroit—Burnside Die & Tool Co., 4718 Gilbert St.—die making machinery.

Mich., Iron Mountain—J. O. Blixt—(veneer manufacturers)—veneer saws and planer.

N. H., Wilton—F. E. Hadley—light upright hollow chisel mortiser and boring machine.

N. Y., Brooklyn—Electric Welding Co. of America, Ft. of Court St.—combination gear ¼ to ½ attachment for cutting angle irons, also to be used as punch press, electric motor driven.

O., East Liverpool—Patterson Foundry & Machine Co.—24 in. shaper.

Pa., Greensburg—Bd. of Education—equipment for metal and woodworking shops for proposed high school.

Pa., Kimbles—Phoenix Utility Co., New York—100 ton, 7 motor crane, for Pennsylvania Power & Light Co., plant here.

Pa., Philadelphia—Pennsylvania R.R. Co., Broad St. Station, S. Porcher, Gen. Pur. Agt.—bolted steel machine, Universal turret lathe, pipe machine.

Pa., Pittsburgh—The Koppers Co., Union Trust Bldg.—5 ton hand power crane.

Va., Richmond—Chesapeake & Ohio Ry. Co., R. M. Nelson, Pur. Agt.—2 wall radial drills; 2 long radial drills; 2 standard radial drills; 4 plant working machines; 25 jib cranes.

Wis., Fort Atkinson—Creamery Package Mfg. Co.—(dairy machinery and supplies)—machinery and equipment for enameling shop.

Wis., Waukesha—American Chest Co., West Ave., C. A. Keebler, Pur. Agt.—(tool chests)—woodworking machinery.

Wis., Wausau—E. A. Pophal Mfg. Co., 1008 South 8th Ave.—(machinists)—lathe, drill press, emery grinder.

Ont., Hastings—Fowlds & Co.—complete planing mill equipment to replace fire loss.

Ont., Smith's Falls—J. D. McGinnis—machinery and equipment for planing mill.

Que., Garneau Junction—Quebec Artificial Coal Co., Ltd., J. A. Lersard, Pur. Agt.—complete equipment for machine shop.

Opportunities for Future Business

Ala., Gadsden—H. Wetter Mfg. Co., South Pittsburg, Tenn., plans the construction of a new plant here on 30 acre site, recently purchased. Estimated cost of buildings $100,000.

Calif., Los Angeles—City has had plans prepared for the construction of a high school including 52 x 131 ft. shop on Indiana St. Estimated cost $325,000. Hunt & Burns, Laughlin Bldg., Archts.

Calif., Los Angeles—Los Angeles Gas & Electric Co., 645 South Hill St., will build a 3-story, 70 x 230 ft. electric shop on Wall St. by day labor. Estimated cost $250,000.

Conn., New Haven—Erwin M. Jennings Co., 27 Harrison St., Bridgeport, is having plans prepared for the construction of a 98x285 ft., showroom, repair and service garage, on Walley Ave. Estimated cost $150,000. Norton & Townsend, 405 Temple St., Archts.

Conn., Torrington—Torrington Mfg. Co., 70 Franklin St., awarded contract for the construction of a 2 story, 60x110 ft., factory. Estimated cost $50,000.

Ia., Des Moines—Klondike Incubator Co., 315 Southwest 9th St., will build a 2 story, 81x212 ft., factory, at Dean and East 24th Sts., by day labor. Estimated cost $40,000.

Ia., Sioux City—Illinois Central R.R., 135 East 11th Place, Chicago, Ill., awarded contract for the foundations for a terminal, including machine shop, etc., here, taking bids on superstructures. Total estimated cost $599,500.

Mass., Brighton (Boston P. O.)—Electric Storage Battery Co., 720 Beacon St., Boston, awarded contract for the construction of a 1 and 2 story, 135 x 274 ft. plant and office building on Ashford St., here. Estimated cost $100,000.

Mass., Cambridge (Boston P. O.)—Letzelter Bros., 2511 Massachusetts Ave., is having plans prepared for the construction of an automobile repair garage at 2495 Massachusetts Ave. Estimated cost $40,000. Private plans.

Mass., Everett (Boston P. O.) — New England Tank & Tower Co., 44 Main St., will soon award contract for the construction of a 50 x 215 ft. machine shop on Tileson St. Estimated cost $40,000. Private plans.

Mass., Lynn—Dearborn & Carter, c/o E. Barp, 333 Union St., Archt., is receiving bids for the construction of a 45,000 ft. repair and service garage at 337 Broadway. Estimated cost $50,000.

Mass., Lynn — Public Building Dept., R. F. Handy, Pur. Agt., will soon award contract for the construction of a 2 story, 50 x 150 ft. garage and repair shop on Bennett St. Estimated cost $80,000. Private plans.

Mass., Northampton—J. Riley, 32 Pleasant St., is taking bids for the construction of a 2 story, 70x100 ft. repair and service garage. Estimated cost $40,000. J. W. Sliwa, 94 State St., Springfield, Archt.

Mass., Willimansett—B. F. Perkins & Son, Inc., Holyoke, machinery manufacturers, are having plans prepared for the construction of a 80 x 260 ft. machine shop and 80 x 150 ft. factory, here. Lockwood, Greene & Co., 24 Federal St., Boston, Archts.

Mass., Worcester—A. Brown, 49 Midland St., awarded contract for the construction of a 2 story, 70x145 ft. garage on Central St. Estimated cost $150,000.

Mich., Battle Creek—The H. B. Sherman Mfg. Co., 12-20 Barney St., plans the construction of a large foundry and brass finishing shop.

Mich., Wayne—Gotfredson Truck Corporation, 3601 Gratiot Ave., Detroit, plans the construction of a factory for expansion to truck and body plant, here. Estimated cost $50,000. Private plans.

Mo., St. Louis—N. O. Nelson Mfg. Co., 10th and Chestnut Sts., awarded contract for the construction of a 20 x 312 ft. warehouse and shops for the manufacture of plumbing supplies on Boyle St. Estimated cost $150,000. P. J. Bradshaw, International Lift Bldg., Archt., will supervise sub-contracts.

N. Y., Brooklyn—Detroit Cadillac Motor Co., 1881 Broadway, New York, is having plans prepared for the construction of a 5 story 115 x 175 ft. repair and service garage at 737 Atlantic Ave., here. Estimated cost $400,000. C. E. Berge, 103 Park Ave., New York, Archt. and Engr.

N. Y., Brooklyn—E. A. Wildermuth, 1061 Atlantic Ave., is having plans prepared for the construction of a 4 story, 65x100 ft. factory for the manufacture of automobile electric equipment on Atlantic Ave. Estimated cost $125,000. A. Goldberg, 164 Montague St., Archt. and Engr.

N. Y., Long Island City—G. A. Shacht Motor Truck Co., 8th and Evans Sts., Cincinnati, O., awarded contract for the construction of a 180x180 ft. plant, here.

N. Y., Long Island City—Standard Oil Co., 26 Broadway, New York, awarded contract for the construction of a 2 story, 155 x 196 ft. machine shop and woodworking plant. Estimated cost $50,000.

N. Y., New York—G. Friedlant Estate, c/o L. Sheinart, 194 Bowery, Archt., will soon receive bids for the construction of a 4 story garage at 113 Chrystie St. Estimated cost $150,000.

N. Y., New York—J. Miller, Borough Pres., Municipal Bldg., will receive bids until June 8th for the construction of a garage addition at 90th St. and East River.

O., Cleveland — Colonial Iron Works, L. M. Steiner, Pres., 881 East 67th St., plans the construction of a 120 x 200 ft. factory on East 176th St. and St. Clair Ave. Estimated cost $75,000. J. H. Petrosky, Company Engr.

O., Cleveland—Frankelite Co., D. Frankel, Pres., 5016 Woodland Ave., awarded contract for the construction of a 3 story plant for the manufacture of lighting fixtures on East 51st St., to replace fire loss. Estimated cost $40,000. Noted Apr. 23.

Pa., Homestead—Carnegie Steel Co., Carnegie Bldg., Pittsburgh, is having preliminary plans prepared for the construction of a 2 story, 50x110 ft. file storage building here. Estimated cost $150,000. Carnegie Land Co., 365 Frick Annex, Pittsburgh, Archt.

Pa., Jeannette—G. M. Johnson Mfg. Co., is having preliminary plans prepared for the construction of a 2 story, 40 x 100 ft. machine shop. Estimated cost $40,000. Private plans.

Pa., Monaca—Colona Mfg. Co., is having plans prepared for the construction of an 80 x 176 ft. plant for the manufacture of thread protectors. Estimated cost $100,000. Private plans.

Pa., Newell — Pittsburgh & Lake Erie R.R., South Smithfield St., Pittsburgh, awarded contract for the construction of a 2 story addition to round house, here. Estimated cost $150,000. Private plans.

Pa., Reading—Philadelphia & Reading R.R., Reading Terminal, Philadelphia, awarded contract for the construction of a 335 x 880 ft. freight car repair shop. Noted May 7.

Ont., Englehart—Temiskaming & Northern Ontario Ry. Comn., North Bay, awarded contract for the construction of engine shop as addition to roundhouse, here. Estimated cost $80,000.

Ont., Toronto — Bell Telephone Co. of Canada, F. Kennedy, Mgr., 76 Adelaide St. West plans the construction of a 3 or 4 story, 250 x 300 ft. garage and store rooms on Shaw St.